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ORGANISATION EUROPÉENNE POUR LA PROTECTION DES PLANTES

EUROPEAN PLANT PROTECTION ORGANISATION

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Séances Techniques de la première réunion du Conseil

18-21 AVRIL 1951

Technical Discussions at first Council Meeting

18-21 APRIL 1951

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2 JUIL 1951

PARIS
14, RUE CARDINAL MERCIER

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PARASITES DES DENRÉES STOCKÉES ET RONGEURS NUISIBLES

(STORED FOOD PESTS AND HARMFUL RODENTS)

PARASITES DES DENRÉES STOCKÉES

(INSECTS IN STORED FOODSTUFFS)

Dr J. W. Evans

Résumé. — *L'auteur décrit tout d'abord les origines de ce qui fut « Le Groupe de Travail pour la Lutte contre l'Infestation des denrées stockées », ses buts, et les raisons pour lesquelles cet organisme vit ses activités absorbées par le Comité International pour la Lutte contre le Doryphore, qui devint ultérieurement l'Organisation Européenne pour la Protection des Plantes. Il expose ensuite l'importance de la lutte contre les insectes parasites des denrées stockées, en particulier par le fait que ces parasites attaquent le « produit final » qui a survécu aux attaques préalables de divers autres parasites et qui a fait l'objet déjà de toutes les dépenses de culture, de récolte, d'emmagasinage et de transport. En ce qui concerne la Grande-Bretagne, la Division pour la Lutte contre l'Infestation, du Ministère de l'Agriculture, a un personnel en campagne d'environ cinquante inspecteurs experts, chargés d'inspecter les produits alimentaires lors de leur arrivée dans les ports, dans les entrepôts, en cours de transport ou de transformation. Des mesures de lutte contre l'infestation sont recommandées lorsque cela semble nécessaire, ou sont appliquées par des compagnies commerciales spécialisées. Une équipe d'entomologistes et de chimistes vient appuyer le travail du personnel en campagne chargé de l'inspection des denrées. Ils sont responsables de l'instruction de nouveaux inspecteurs ; ils doivent tenir les inspecteurs informés des développements scientifiques, examiner de nouvelles méthodes de lutte, et conseiller la Division, d'une façon générale, sur toutes les questions du domaine scientifique. Les recherches de base sur les insectes parasites des denrées stockées et leur destruction sont exécutées par le Laboratoire d'Infestation parasitaire attaché au Département des Recherches Scientifiques et Industrielles, avec lequel la Division entretient une étroite collaboration.*

Les trois développements techniques les plus intéressants de ces derniers mois, et dont la Division a été appelée à s'occuper, ont été l'utilisation de tétrachlorure de carbone, de butoxyde de piperonyl et d'HCH.

a) *Lors de l'utilisation de tétrachlorure de carbone dans les* coffres de silos, *il a été constaté qu'une dose d'un gallon* (4,54 *litres*) *de tétrachlorure pour* 13 *tonnes de céréales représente la dose appropriée par des températures de plus de* 60° *F, tandis qu'à une température de plus de* 80° *F, un gallon suffit*

pour 16 *tonnes. Le produit de fumigation doit être répandu le plus régulièrement possible à la surface des céréales, et la période d'exposition ne doit pas être inférieure à sept jours. Pour les* céréales stockées en vrac sur le plancher, *le tétrachlorure de carbone seul ne donne pas de résultats très satisfaisants, car il pénètre rapidement jusqu'à la base du tas, puis se répand latéralement le long du plancher, laissant les parties supérieures sans traitement suffisant. Le dichlorure d'éthylène n'a pas les mêmes qualités de pénétration, de telle sorte qu'un mélange des deux produits paraît approprié pour le traitement des denrées entassées par terre.*

b) *Il a été constaté aux Etats-Unis d'Amérique que le butoxyde de pipéronyl augmente de beaucoup l'action toxique des pyrèthres employés comme insecticides, et des mélanges de ces deux produits de fumigation laissent entrevoir la possibilité de disposer d'un produit à bon marché qui pourra être employé pour la lutte contre les insectes parasites des entrepôts et magasins, au lieu des pulvérisations de pyrèthre à l'huile. Des expérimentations entreprises en Angleterre ont permis de confirmer que le butoxyde de pipéronyl augmente la toxicité des pyrèthres, mais non l'affirmation américaine selon laquelle le mélange serait plus stable que les pyrèthres seuls. Un autre avantage du mélange réside dans le fait que le butoxyde de pipéronyl, au contraire du pyrèthre, est toxique pour les acariens, ce qui est un fait important à considérer lorsqu'il s'agit de pulvérisations dans les entrepôts.*

c) *L'auteur décrit des essais préliminaires entrepris à l'aide de l'hexachlorure de benzène comme produit de fumigation pour des céréales, légumes secs et autres denrées alimentaires non transformées, ceci à la suite d'une décision prise par le Conseil Britannique des Recherches Médicales, d'autoriser un maximum plus élevé de la concentration de HCH tolérée dans les produits alimentaires.*

Dans le domaine des progrès réalisés au point de vue administratif, le Décret pour la Prévention des Dégâts causés par les Parasites, dont il avait été question à la Conférence de Florence, est devenu une loi en Grande-Bretagne à la date du 31 *mars* 1950. *Toute personne dont les fonctions comprennent la fabrication, l'emmagasinage, le transport ou la vente de denrées alimentaires ou récipients pour ces denrées doit, à moins d'en avoir été expressément exemptée, envoyer par écrit au Ministère de l'Agriculture un rapport sur l'existence, pour les denrées alimentaires, de tout danger de dégâts substantiels, qui pourraient être causés par des insectes parasites ou des acariens. L'auteur décrit ensuite la procédure qui se trouve appliquée dans un tel cas.*

Those who are present today who have in the past attended meetings of the former European Infestation Control Working Party will doubtless understand the reasons why one of the items on Schedule 2 of the Convention relates to pests of stored foodstuffs. Those who have had no connection with, or knowledge of, this Working Party may be puzzled as to why insect and rodent pests of stored food and rodent pests of crops should be the concern of a European Plant Protection Organisation ; for surely, they may think, such an Organisation should concern itself solely with major pests which are either a genuine menace to the agriculture and horticulture of a great part of Europe, or with recently established organisms with a present restricted distribution on our Continent.

I will not waste your time with a detailed account of the activities of the I. C. W. P. It is sufficient to say that it was set up in 1945 under the Chairmanship of Mr. W. McAuley Gracie, comprised 16 member countries and held several meetings and that its purposes were briefly as follows : —

to draw up a standard code of general principles to be adopted collectively by the member countries with regard to the reduction of infestation (and by infestation was meant insect and rodent infestations of stored food) ; to serve as a permanent committee for consideration of problems of infestation ;

to formulate practical recommendations to Governments on the administration, organisation and operation of Infestation Control with the object of eventual legislation on the subject.

At the last meeting of the Working Party, which was held in Florence in January 1950, it was decided that its activities should be merged with those of the International Colorado Potato Beetle Committee, and it was this joint Committee which became the forerunner of the European Plant Protection Organisation.

Now, stored product insects (we are concerned with insects only and not with rodent pests at the moment) differ from other organisms in the schedule in that they are, to all intents and purposes, universally distributed and hence not subject to plant quarantines ; also, because they are unspecified in the schedule. A moment's thought will show that these pests, even although in a different category, are nevertheless well placed in the schedule, if it is generally agreed that the primary purpose of plant quarantines is the prevention of the access of new pests for two well-defined reasons. The first of these reasons is that if such pests, once introduced and established, are *not* controlled, they may cause a loss of foodstuffs, and if they have *to be* controlled, they usually make necessary a considerable expenditure on labour, machinery and spray materials.

The prevention of needless expenditure of money is of importance, but even more important at the present time is the saving of food. If next one considers which item in the schedule is of the greatest significance from the point of view of the prevention of loss of potential food, it is certain that it is the one relating to stored product insects, and the reason the importance of these insects is not more generally appreciated is because they are so well known and are regarded in many countries as inevitable, and so taken for granted.

The San José Scale, for instance, which is rightly thought of, in parts of Europe, as a dangerous pest, is, in many countries, in which it has been long-established, regarded as but of little account since it is readily controlled by orchard sprays which have to be applied for other purposes. In any case, it is only those who grow, buy, sell, or eat apples, and a few other fruits, who are likely to be greatly affected by its presence.

Everyone, however, eats bread, hence all are concerned with pests that infest flour and wheat ; some are lucky enough to eat meat, and so they are interested in the insect pests of animal feeding stuffs; and finally every householder must have at some time or other suffered loss from beetles eating their biscuits, from mites in their flour and from caterpillars in their dried fruit. Further, stored product insects are directly destructive to harvested as apart from potential crops, that is to say, they attack the end product, which has survived earlier attack from a variety of pests and which has already borne all the expenses of cultivation, harvesting, storage and transport.

It is, in fact, because these pests are of universal occurrence and in the aggregate the cause of such tremendous losses that they are worthy of a position in the Schedule. No purpose would be served by specifying them ; there are so many and they are all well known.

I propose to tell you very briefly what we do in Great Britain in an attempt to limit the depredation of these insects, before we discuss the items on the Agenda which are concerned with recent technical and administrative developments.

The Infestation Control Division of the Ministry of Agriculture of Great Britain has a field staff of some 50 Scientific Inspectors. These inspect foodstuffs on arrival at ports, in store, and during transport and processing. They ascertain the precise nature of infestations, assess their significance with regard to intentions for further storage or distribution, and when necessary recommend control measures. They do not themselves undertake control measures, and treatments, when needed, are given by commercial servicing companies. Supporting these field officers is a team of entomologists and chemists, who, as well as giving instructional courses to new Inspectors, are responsible for keeping Inspectors informed of developments from research

laboratories, arranging for tests of new control techniques, and advising the Executive side of the Division on scientific matters generally.

Basic research with stored product insects and their control is not done by the Ministry of Agriculture but by the Pest Infestation Laboratory of the Department of Scientific and Industrial Research, with which the Division works in close co-operation.

RECENT DEVELOPMENTS AND PROGRESS IN INFESTATION CONTROL

a) Technical

The three most interesting developments in the control of stored product insects that have taken place in recent months and with which the Infestation Control Division has been concerned, relate to the use of carbon tetrachloride; piperonyl butoxide and benzene hexachloride.

Carbon tetrachloride

At one time the only fumigant used in silo bins was « Cyanogas » which has given good service over the years, but by its very nature is liable to irregularity in efficacy. This is because to mix uniformly a small quantity of a dense solid with a much larger quantity of a lighter solid is a technical problem of much difficulty.

When the use of methyl bromide became widespread it was hoped that it would replace « Cyanogas » and extensive experiments were made by the Pest Infestation Laboratory of the Department of Scientific and Industrial Research. Their work showed that it was not possible to obtain uniform distribution of the gas in deep bins by surface application or even by injection, and that only by circulating the fumigant for a few minutes could this be achieved. The circulatory method is undoubtedly the most efficient way of fumigating grain, since large tonnages can be handled with complete success in a short time once the equipment is installed (1,000 tons a week could be handled in a single 200 ton bin).

Following the failure of the surface application, using methyl bromide alone, an attempt was made to use a heavy liquid as a carrier for the methyl bromide — an expedient for which success had been claimed in Canada and the U. S. A. — and carbon tetrachloride was chosen as the carrier. The results obtained showed that the distribution of methyl bromide was very little different from that in the original tests. On the other hand, the carbon tetrachloride distribution was encouraging, and this gave rise to the suggestion that although high CT products would be necessary to achieve adequate results with the carrier by itself, it might be possible to reach these figures in all parts of the bin with an increased dosage.

In fact, it was expected that fumigation with carbon tetrachloride might prove more satisfactory than a « Cyanogas » fumigation, and would have the additional advantages of being less hazardous and of usually avoiding the need for turning. On the other hand, it was, of course, appreciated that it could not compare in efficiency with the use of methyl bromide in bins equipped with gas circulating gear.

Recently some tests were made by the Pest Infestation Laboratory on the use of carbon tetrachloride in silo bins, and as the field trials proved promising they have been followed by several practical applications. It has been found that a dose of 1 gallon of carbon tetrachloride for 12 tons of grain is suitable at temperatures over 60° F. while for grain at temperatures over 80° F. a gallon for 15 tons is sufficient. The method is unsuitable for grain at a temperature of less than 60° F. The usual means of application is to add the fumigant as evenly as possible to the surface of grain, and the exposure time must be not less than 7 days.

The results obtained to date have been satisfactory except in those instances where local « hotspots » have been present in the grain mass, but even in such cases failure has not always resulted.

Concurrently with their silo work the D. S. I. R. workers carried out some tests on bulk grain on floor storage, using both carbon tetrachloride by itself and mixtures of the latter with ethylene dichloride.

It was found that carbon tetrachloride on its own was not very satisfactory, because it penetrated rapidly to the bottom of the heap and then spread laterally along the floor leaving the upper parts insufficiently treated. Ethylene dichloride, on the other hand, had not the same penetrating qualities (which is why it is not so satisfactory for silo work despite its higher toxicity to insects) so for floor storage a mixture of the two is preferable to either alone. In principle there is no restriction on the size of the stowage which may be treated by this method, although operational difficulties may well set an upper limit.

Piperonyl butoxide

The Pest Infestation Laboratory has done a certain amount of work with piperonyl butoxide. This substance, which is of very low toxicity to mammals, was shown in the United States to greatly increase the toxicity of pyrethrums to insects, and pyrethrin-piperonyl butoxide mixtures appear very promising as cheaper substitutes for straight pyrethrum-in-oil sprays for the control of warehouse insects. While piperonyl butoxide has been shown to synergize pyrethrums in oil when tested on stored product beetles, it has not been found that the mixture is more stable than pyrethrums alone, as has been claimed in America.

The mixture is useful also for a reason other than that it saves expense, for piperonyl butoxide, unlike pyrethrum, is toxic to mites, and this is an important consideration when warehouse spraying is being undertaken.

Benzene hexachloride

Recently the Toxicology Committee of the British Medical Research Council recommended an increase in the maximum permissible concentration of BHC in foodstuffs, and they now permit a maximum concentration of 2.5 p.p.m. of the gamma isomer of BHC when the BHC that is used contains 12 per cent or more of the gamma isomer. This recommendation is based on the consideration of the experimental evidence of the toxicity of BHC to mammals. As a result of this raising of the permissible concentration of BHC, field trials have been planned by the Infestation Control Division on its use with cereals, pulses and certain other unprocessed food materials. These trials will be of a preliminary nature, and wholesale and unrestricted admixture is not yet contemplated in any way. Further, all developmental work will be conditioned by the need for constant analytical tests, and even though it is well known that most of a dust insecticide is removed during the normal course of milling, it is not proposed to sanction amounts in excess of those recommended by the M. R. C. Committee.

Some preliminary tests have been made with a number of insects to see whether the permissible tolerance limit of BHC in grain will be effective against them, and it has been found that it is so except against *Oryzaephilus surinamensis*. Tests are now being made on the technique of admixture, and later the question of any possible resulting taint will need to be investigated.

On a weight by weight basis, the gamma or insecticidally active isomer of BHC is considerably more toxic than DDT to most insects of stored food, and an admixture of 2.5 parts of gamma BHC would normally be appreciably more effective than would an admixture of 7 parts of DDT under the same conditions.

The technical grade of BHC usually contains about 13 per cent of the gamma isomer of BHC with other isomers as impurities. These impurities show only very slight insecticidal activity with a marked toxicity to mammals. Wherever foodstuffs are concerned, therefore, a preparation containing the purified gamma isomer rather than the technical grade of BHC should be employed. The choice of such a preparation has the additional advantage that the smell is less than when BHC of technical grade is present.

Revised figures for DDT have not yet been made available by the Medical Research Council and the tentative limit of 7 p.p.m. remains in force for the time being.

b) **Administrative**

At the meeting of the Infestation Control Working Party held in Florence last year, I reported that the Prevention of Damage by Pests Bill was to become law in Great Britain on March 31st of that year and it duly became so.

Under the provisions of this Act, every person whose business includes the manufacture, storage, transport or sale of food or food containers must, unless exempted by the provisions of certain regulations, give notice in writing to the Minister of Agriculture and Fisheries whenever he becomes aware of a risk of substantial damage to food occurring owing to the presence of insects or mites in premises, vehicles, equipment, food or other goods or in food containers in his possession or control in connection with the business.

Further, when a notice has been sent in in respect of infested food or goods, they may then not be moved without the Minister's consent for 3 working days after the date of notification except from certain specified places. In order to avoid or mitigate damage to food, the Minister is empowered to issue directions to those responsible, requiring them to undertake steps for preventing the spread of infestation and for the treatment of infested food, goods, premises, vehicles and equipment.

LUTTE CONTRE LES RONGEURS
RODENT CONTROL

Dr J. W. Evans

RECENT DEVELOPMENTS IN CONTROL METHODS IN ENGLAND & WALES

Résumé. — *Le Dr Evans mentionne une série d'essais entrepris en Angleterre, avec l'appui des autorités locales, sur le produit dénommé « Warfarin » (composé* 42). *Les premiers résultats sont prometteurs. Ils ont démontré que lorsque le Warfarin était utilisé à* 0,01 % *dans la farine d'avoine contre le* Rattus norwegicus, *et à* 0,025 % *contre le* Rattus rattus *et laissé en place pendant un laps de temps variant de deux à trois semaines, il constituait, sous certaines réserves, un poison efficace. C'est dans le cas d'une infestation relativement concentrée, lorsque les appâts peuvent être placés facilement sur le chemin des rats et lorsque les autres disponibilités alimentaires sont réduites, que le produit présente la plus grande utilité.*

We have no new advances in control methods to report arising as a result of our own research, since our Research Section has recently been reorganised and is only now settling down to work, and the most interesting new developments with which we have been concerned have related to trials with Compound 42, known also as Warfarin, a material which has received much publicity in American Journals and which has many promising features.

Warfarin is an anti-coagulant, the eating of which by rats in small doses over a period of time leads to internal haemorrhage and death. Unlike higly toxic poisons, its ingestion does not appear to induce shyness or the avoidance of further feeding on the same trated bait, and for this reason it is of special interest to us, as it can be used without preliminary pre-baiting.

Our normal custom when dealing with a new material is to arrange first of all for extensive laboratory and field trials to be undertaken by our research staff. Then, if these trials prove

satisfactory, the material is tried out further by the staff of the Field Instructional Section before general recommendations are given for its use. In the case of Warfarin, we have tried another and more direct method of approach, partly because so much work has already been done with it in America, but also because we wished for a quick indication as to whether this material warranted a place in our rodent control methods.

We arranged for some trials against both species of rat to be carried out in different parts of the country by local government officials. All that we did was to undertake a limited amount of research to discover a suitable bait base, to arrange for the despatch of supplies of Warfarin, bait base and trays, and we called a meeting at our Headquarters of all those who were to take part in the trials so that our plans could be discussed and fully understood. As well as this, some members of our Headquarters staff visited the various towns involved, inspected the chosen sites and kept an eye on the trials whilst they were in progress. These trials have not yet all been completed, but the preliminary reports that have been coming in seem promising. They have shown that where Warfarin was used at a strength of 0.01 % in oatmeal against *Rattus norvegicus* and at a strength of 0.025 % against *Rattus rattus*, in both instances in an oatmeal base, and left in position for periods ranging from 2 to 3 weeks, it is effective subject to certain reservations. Thus, as is the case with other poison baits, it is most useful when the infestation is relatively concentrated and the baits can be easily placed on rat runways and when the alternative food supply is scarce.

RECENT DEVELOPMENTS IN RODENT CONTROL IN THE NETHERLANDS

Dr L. Caudri

State Phytopathological Service, Wageningen

Résumé. — *Les expériences acquises par les Services Phytopathologiques des Pays-Bas dans l'application de rodenticides modernes sont décrites dans ce travail. Le fluoracétate de sodium* (1080) *est puissant et extrêmement toxique pour les rongeurs, mais son utilisation est liée à certains risques et ce produit ne devrait être manipulé que par des spécialistes entraînés. L'Antu* (α *naphtylthiourae*) *est moins toxique et par conséquent plus populaire, mais il y a une différence frappante entre les doses qui sont mortelles pour les rats bruns et celles à administrer aux rats noirs. D'autres dérivés de la thiourée sont mentionnés. Des expérimentations portant sur des dérivés de la coumarine, tels que le Warfarin* (*Mélange* 42) *sont décrites, de même que des essais de fumigations* (*avec* CO_2) *de pommes et de poires stockées, marchandises exposées à d'importants dégâts dûs aux souris, pour lesquelles la pose d'appâts ne donne généralement pas de résultat.*

In 1080, *sodium fluoracetate*, we have a powerful rodenticide. It is highly toxic to rodents, is taken readily and is chemically stable. Disadvantages are the high solubility in water, which may cause washing-out, and in other solvents. The resulting rapidity of absorption makes the chemical extremely dangerous, not only to rats. I am aware that the danger can be exaggerated. Rightly Ormsbee compares as follows : For man the lethal dose is 5 mg/kg = 350 mg per 70 kg, but the concentration in the bait is low. 3.3 ounces of bait with 1080 would be fatal for the average man, whereas it is 3.2 ounces with thallium in the customary concentration.

In my opinion, however, the greatest risks, with any chemical, occur with the pure material before it is mixed with bait. I do not know whether this is the reason that in general the attitude towards 1080 is one of suspicion. In most countries it has not yet passed through the experimental stage ; in practice it is only used in exceptional cases. I think everyone agrees that it should only be handled by skilled operators.

Antu, α naphtylthiourea, is less toxic and therefore more popular, but its action is more complicated. The cause of death is the development of liquid in the lungs which causes the animal to suffocate. The susceptibility of rats of one species seems to differ greatly with age and in various seasons, and there is a remarkable difference between the lethal doses for brown and black rats namely, 5-9 mg/kg for brown and over 500 mg/kg for black. The poison is therefore chiefly used against brown rats and mice, where good results have been obtained. In Holland these results were better when the chemical was dusted in concentrated form than when it was mixed with baits, where the palatability was badly influenced even at a percentage of 1/3 %.

Even so I think that with Antu we must be careful with regard to the toxicity. For man the LD is usually given as 4000-5000 mg/kg. This figure is derived from Richter's data on monkeys. Here, however, I must remind you of the striking difference between brown and black rats which physiologically are so nearly related, and I must ask whether man should be compared to the monkey or to the pig which has a LD 50 of only 50 mg/kg. Perhaps this is one of the reasone why Antu has not quite fulfilled its promise in spite of extensive publicity.

Other thiourea-derivatives are now being developed and they may be improvements. I mean sodiumparachlordiazothiourea which is the active compound of Muritan, and acetylphenyl- and diacetylthiourea which are claimed to be taken readily, to have a LD 50 of 5 mg/kg rat and in addition to be specific and to be harmless to domestic animals Unfortunately I cannot give you data on Dutch experiments with these compounds, as the samples which we asked for have not yet arrived.

Quite a different action is performed by the *coumarin-derivatives* such as Compound 42 or Warfarin. They interfere with the production of prothrombin in the liver and consequently give a diminished blood-coagulation. A typical feature is that the highest kill of the animals by internal bleeding is reached when the poison is given in minor quantities on successive days. At Wageningen we worked with Dethmor, a preparation containing 0.5 % of the active ingredient. Wild rats were fed a daily portion of 1 gr of the preparation and took it surprisingly well even when already diseased. All brown rats that took 0.8 to 1 gr for 5 days died. When given 1 or 0.5 gr for only 2 days 25 % survived. The same percentage survived in a series where the animals took 3 or 2 gr at once. Black rats were less susceptible. After 5 days at 0.8 to 1 gr daily nearly 50 % survived. It seems that for this species the procedure must be carried on for an even longer period. This at once shows the disadvantage. The whole system will be too elaborate and it will be impossible to ensure that baiting is carried out correctly for so many times. Perhaps the preparation Tomorin, where the coumarin-compound is dusted on to the runways, gives the key, as in that case rats and mice might be expected to do the work themselves.

Finally I should like to mention some Dutch experiments on *fumigation* of stored apples and pears, where a few mice can do great damage and baiting is usually unsuccessful. In one case 15 % CO_2 for 4 hours killed the mice, whereas damage to the fruits due to low temperatures could be avoided (cost, 1 guilder 80 cts per 100 kg fruit). For further experiments we used methylbromide at 450 gr per 100 cubic meters during 5 hours (cost, 17 cts per 1000 kg). In laboratory experiments 154 gr during 5 hrs at 0-4° C. killed housemice, whereas 308 gr killed housemice, brown rats and voles within 3 hrs. In practice, however, we must expect considerable loss of fumigant.

I have mentioned some « new » chemicals. I have not mentioned them all, and I am sure that others will soon arrive. Nevertheless I do not think that one of them will ever satisfy all countries at a time. The possibilities of any chemical will largely depend on the local circumstances in each country. If we take for example 1080, or other drugs which can best be applied in drinking water, I must say that in Holland this method of treatment will always remain unreliable as there is always other water available. In the same way, specific difficulties in the orga-

nisational field may arise in other countries. An exception should be made with regard to repellents, which might work universally. Therefore I am greatly interested in the antibiotic *Actidione* which was reported by Traub and his co-workers to have such outstanding properties as a repellent.

ORGANISATION OF RAT CONTROL IN DENMARK

Prof. H. Wichmand
Director of the Government Laboratory, Springforbi

Résumé. — *L'auteur rend hommage aux efforts déployés par Emil Zuschlag qui, agissant comme pionnier en la matière, établit les bases de la lutte contre les rats au Danemark, et de la première loi sur la dératisation, votée en* 1907. *Selon les termes de la législation actuellement en vigueur, les communes et les paroisses ont individuellement la responsabilité de veiller à la dératisation, et la plupart d'entre elles créent, dans ce but, un comité spécial. Les activités de ce comité sont contrôlées par deux conseillers désignés par le Ministère de l'Intérieur; un Comité National de Dératisation, appointé par ce Ministère dispose de crédits atteignant environ* 1 *million de francs par an pour assurer la propagande et la publicité, de même que d'allocations pour des buts spécifiques. Des questionnaires remplis chaque année dans les paroisses et les communes fournissent des renseignements complets sur les mesures appliquées, et les dépenses. Dans les cas où le nécessaire n'a pas été entrepris, lorsque l'état de choses n'a pas pu être amélioré à la suite de négociations, le Ministère de l'Intérieur peut imposer des mesures obligatoires ; tel n'a été le cas que dans quatre paroisses, au cours des treize dernières années écoulées.*

La loi sur la dératisation n'indique pas de méthodes de lutte spécifiques, laissant cette responsabilité aux conseils de paroisses et des communes. Dans des circonstances normales, toutes les maisons doivent être inspectées au moins deux fois par an, de préférence au printemps et en automne, à des périodes déterminées par le Comité National et s'échelonnant sur l'ensemble du pays. Dans les maisons où des rats ont été trouvés et dans les maisons voisines, du poison doit être déposé. Les paroisses situées dans des régions isolées peuvent conclure entre elles des accords afin de déterminer la date de la campagne à entreprendre et les méthodes à appliquer. Le résultat d'accords de ce genre — qui sont prévus dans le texte de la Loi — ont été si encourageants que les autorités essaient de répandre encore davantage ce mode de faire.

Les fonctionnaires chargés de la dératisation ne s'occupent pas seulement du travail des paroisses et des communes ; ils ont aussi pour tâche de surveiller les bâtiments municipaux, les parcs et jardins, les installations techniques et les égouts.

Comme pour les rats, ce sont les Municipalités qui ont la responsabilité d'appliquer la lutte contre les taupes. Cette lutte est organisée par les syndicats agricoles et des résultats excellents ont été obtenus dans de vastes régions du pays. La méthode employée consiste en l'utilisation de vers de terre empoisonnés à la strychnine.

In Denmark the early organization of rat control was almost exclusively due to one man, who was active during the last part of the past and the first part of the present century. His name was Emil Zuschlag. Through his indefatiguable work, spreading information and propaganda, he contributed a decisive stimulus to the interest in rat control, not only in Denmark, but in the whole world. Zuschlag was one of the first to recognize the hygienic significance of the rat and its importance as a pest, and to endeavour to organize control on a large scale. He undertook extensive investigations on rat control and published a number of books, one of which was in French : « Le rat migratoire et sa destruction rationnelle ». He also founded an international society « Association internationale pour la destruction rationnelle des rats ». As far as I know all European nations were members of this society.

As a result of his work Denmark got her first Rat Act in 1907. Today this Act looks very primitive, depending exclusively upon the reward-system known in those days. At the same time all import and breeding of wild rats were prohibited in Denmark, and this ban is still in force. During the first 18 weeks after the Act came into force 200.000 tails were delivered. This great result was the second achieved by Zuschlag in the field of organization. His first result, the international organization, was a success in spite of the temporary break caused by the first world war. This international work culminated in the first international congress on rats in Le Havre in 1928. The congress appointed a board : « La Ligue internationale contre le Rat », and in 1931 the French professor Petit published an extensive report, but after that the movement died out, for reasons unknown to me.

Anyhow it is my duty to speak on organization of control. On this subject, I think, experience is gained more easily in a small country like Denmark.

In Denmark the responsibility for rat control rests on the smallest administrative units, namely the individual boroughs and parishes, and this arrangement has been found most effective during the 13 years in which the present Act has been in force. In the smallest parishes rat control is organized by the chairman of the parish council, who appoints the operator and decides which poisons are to be used. The bigger parishes and all boroughs have special committees for rat control composed of councillors. Further, some counties have their committees, and finally the Home Office appoints « The National Committee for Rat Control ». This committee receives an annual grant of approximately £ 1000 for propaganda and distribution of information, and may have further grants for special purposes.

This system of committees is extremely useful, for it secures the interest and support of a very large number of persons.

But it is necessary to have a supervising authority, and to that end we have two advisers, directly responsible to the Home Office. It is the duty of these advisers to see that the parishes and boroughs fulfil the responsibilities placed on them by the Act. Further, they are obliged to spread information and give instructions concerning control and ratproofing.

To support the supervising activity of the advisers, the parishes and boroughs are required once a year to fill in a questionnaire and send it to the advisers. This is an extensive questionnaire, but the questions are put as simply as possible, and when filled in the form gives a complete picture of what has happened in the parish or borough, and the cost of the control operations in the financial year.

Now it is obviously impossible in every borough and parish to find persons who show sufficient interest in rat control, and, of course, where the interest is lacking within the council, the necessary control measures are not taken against the rats. Especially when they are exclusively composed of farmers, the parish councils are sometimes close-fisted to such a degree that they prefer the rats to the control expenses. In these cases much can be accomplished by negotiation, and the advisers try to convince the councils of the profit that may be gained by the necessary expenses for rat control. However, in infrequent cases, negotiations are not sufficient. To meet such cases, a section of the Act empowers the Home Office to require a parish to undertake specified control measures. Twice during 13 years it has been necessary to use the section in question. In all, 4 parishes were affected, and they were required to undertake rat control in accordance with the instructions given by the advisers.

We advisers definitely prefer voluntary action, even though we have to admit that when preaching in the parishes and especially when talking of rat proofing, we often feel like missionaries in Africa. The fact is that the parish councillors are elected chiefly by the landowners, and of cause it is a precarious matter, when the councillors have to give their electors orders concerning rat proofing and cleanliness. Everybody understands that poisoning is necessary, but when

money and work are required, the understanding often fails, and therefore, as far as possible, rat proofing should be supervised by an independent organ in the small parishes. In the bigger boroughs the municipal civil engineer may administer this part of the Act, and of course he has to administer all the sections that are met with aversion by the house-owners.

In my opinion the Danish Rat Act gives an excellent model of organization of rat control, but I do not intend to go through the whole Act, but merely to examine a few points of general interest. For example, how often should poisoning be carried out? I will not claim that we have solved this question entirely, for in the Danish Act we have contented ourselves with a compromise. The Act states : « In all boroughs and parishes the councils are bound to see that systematic eradication of rats is carried out throughout their territory *at adequate intervals* ». It may seem to be a weakness of the Act to state « adequate intervals » and provide no definite guidance. In fact it is a strength, for it places responsibility on the parish and borough councils. Moreover it would be absurd to require control measures to be carried out in parishes free from rats, or to require control throughout a parish in which only a few houses are infested.

The authorities interpret the section in question in this way : All houses have to be inspected at least twice a year, preferably in spring and autumn, and in those houses where rats are found, and in the neighbouring houses, poisons must be laid. The National Committee for Rat Control reminds all parish and borough councils when these half-yearly campaigns have to be carried out, so that control is operated simultaneously all over the country. This concerted action is very important, and above all cooperation between boroughs and the neighbouring parishes is invaluable. In isolated areas agreements between parishes may also be useful. For the establishment of such agreements the committees are effective instruments. The agreements may deal with the date of the campaign, use of the same rat poisons, joint purchase of rodenticides or joint contract with a firm, etc. The Danish Rat Act even contains rules for establishing such agreements, and results of the existing agreements are so promising that the authorities are trying to extend the system.

I shall not here discuss the question whether the municipal staff ought to carry out the control or whether it should be left to private firms. In Denmark the parishes and boroughs may choose freely, and good results have been reached by both methods. However, experience has shown that careful supervision is necessary, when the work is left to a private firm.

I presume that other countries, too, have rat control officers, and I want to emphasise that these officers have not fulfilled their duty simply by seeing that the parishes and boroughs show enough energy concerning poison-laying and demands on house-owners for rat proofing and cleanliness. Rat control officers must also have to look after municipal buildings, parks and technical plants, as for instance the sewers. I need not tell this audience about the problems connected with control of sewer rats.

A much more difficult task is to teach nice old ladies not to feed the rats : in the parks they pour baskets full of waste bread out for the birds, and in the courtyards they place lots of food for the cats. In Copenhagen these nice old ladies constitute one of our greatest problems, and we have found it necessary to distribute a leaflet to all homes trying to educate them.

The refuse dumps constitute a special problem. We are trying to solve this problem by various means : 1) Incinerators are of course one hundred per-cent effective, but unfortunately they are too expensive to run. 2) Separators are cheap to run, but apparently they are not quite effective, since eatable particles constitute an important part of the finest stuff used for cover. 3) Last but not least I shall mention the Dano plants. They are rather expensive to run, but nevertheless they are favoured by us, because they transform the valueless refuse into excellent mould.

If rat control is organized, the effectiveness of the rat poisons must of course be supervised by the authorities. Obviously the best arrangement would be a by-law, prohibiting the sale and

use of rat poisons not approved by the authorities. In Denmark the manufacturers pay for the supervision through a sales tax.

This statement has dealt with rat control and not with rodent control as a whole. I apologize for not having covered the whole of the subject, but as matter of fact we have no organized control of any other rodents, since, in Denmark, no other species of rodents is constantly noxious to such a degree that permanent measures are necessary.

Some years ago squirrels had become too numerous in Denmark, but in less than a year this problem was solved by offering a reward of about the shilling for each squirrel shot.

Although moles are not rodents, it may be of interest to say that in Denmark we have organized control of moles. Like rat control this is a municipal affair, but it is organized by the farmers' unions, and in large parts of the country, where control has been carried out, results are excellent. The control is by means of earth-worms poisoned with strychnine.

From the literature and from the reports of my colleagues abroad, I know that mice are very important in the countries to the south of Denmark, and I regret being unable to give any contribution towards organized control of these animals. Even though they are not nearly so important in Scandinavia as here, it is quite possible that in certain years organized mice control might be profitable, and, therefore, I hope to hear something about this subject from other participants in this conference.

ROLE DE L'ORGANISATION EUROPÉENNE POUR LA PROTECTION DES PLANTES

RÔLE OF THE EUROPEAN PLANT PROTECTION ORGANISATION

This subject provoked a full discussion, to which the principal contributors were the delegates from Great Britain and the Netherlands. Their suggestions, which received general approval, are given below.

Résumé. — *Dans la discussion, le délégué de la Grande-Bretagne suggère que l'Organisation pourrait avoir une très grande utilité en servant comme centre d'échange d'informations sur les problèmes intéressant chacun des gouvernements. Par exemple, la Division pour la Lutte contre l'Infestation s'intéresserait à connaître tout ce qui se fait dans les autres pays en matière d'utilisation d'insecticides synthétiques en incorporation directe aux céréales. Le Dr Evans cite un certain nombre de questions spécifiques auxquelles il serait heureux d'avoir les réponses du plus grand nombre possible de pays. Le Dr Caudri (Pays-Bas) estime que l'Organisation devrait fonctionner comme centre de coordination de toutes les techniques expérimentales, afin de tenter d'assurer l'uniformité des méthodes dans les différents pays. Il fait allusion, en outre, au rat musqué ; bien qu'il ne s'agisse pas là, à proprement parler, d'un parasite des récoltes, ce sont presque toujours les services de l'Agriculture qui sont appelés à s'en occuper, dans les pays infestés par ce rongeur. (Sur cette question, la Conférence décide à l'unanimité de recommander au Comité Exécutif d'entreprendre un examen du problème, afin que soit assurée une coordination des activités dans le domaine de la lutte contre le rat musqué).*

Dr J. L. EVANS

In Article V of the Convention the proposed functions of the Organisation are set out in detail. These functions are all desirable in themselves, but it might well come about that because of the fact that stored product pests do not represent new threats, and hence do not create a sense of urgency, they might well be overlooked as being of but little importance. I think that the part of paragraph (*a*) (7) which relates to the exchange of scientific information is the significant one here.

I suppose that it is correct to state that at present Great Britain leads the world in measures taken to control pests of stored foodstuffs ; further, the staff of the Infestation Control Division of the Ministry of Agriculture is in constant touch with new scientific developments in this field. Nevertheless, we remain ignorant as to the actual control practices of other European countries, and particulars of these would be of great interest to us. We believe, for instance, that grain insects can be controlled by the admixture of certain synthetic insecticide dusts, but for various reasons are only now about to embark on experiments in the use of these. We would therefore like to learn whether such materials are in wide use already in other European countries, and of the nature of the regulations governing their employment.

If the Organisation could act as liaison centre to which queries for information of this nature could be passed, it would be fulfilling a useful function, and one which would become increasingly so as its contacts became wider. I do not think that much would result if it was left to the Organisation to collect information and circulate it, but if replies to specific requests were circulated to all member countries, it will stimulate interest and serve to establish valuable contacts which should result in real progress being made in the control of stored food insects in Europe generally.

I have mentioned, in a general way, our interest in finding out what is done in other countries about the use of synthetic insecticides in direct admixture with grain.

It might prove helpful at this stage to turn a vague request into a concrete one and thus provide an example of the manner in which use might be made of the Organisation as a liaison centre.

We would like to receive from as many countries as possible replies to the following queries :

I) Have DDT or BHC dusts been mixed with grain regularly under practical conditions? If so, (*a*) where has the admixture been made (e. g. in farmer's bins or in port stores or large silos)? (*b*) how was the admixture carried out, and at what dosage? (*c*) what results were obtained in practice? (*d*) have there been substantial objections from workmen or other people handling the grain, on account of their coming into contact with dust during addition of the powder or on subsequent movement of the grain? and (*e*) is the method employed at the present time?

II) Do the medical or other pure food authorities object on account of the possible harmful contamination of grain that is treated? If so, have any legal, or tentative, limits been set?

Dr L. CAUDRI

It seems to me that there are two items in which we could do with some more coordination. One lies before the actual control and one comes after it. The one before is testing of the rodenticides, of which we now have an evergrowing list, most of them covered by reports stating their good qualities. Much work has been going on in different centres, especially in Great Britain. But some questions remain to be solved before a much desired experimental uniformity could be reached ; for instance the choice of the material, should it be the wild rat or the white rat? The other item is still more important. I think that many countries are greatly in need of a reliable and objective evaluation of control-results obtained in practice. Again I may refer to the splendid efforts of the British Agricultural Research Council and the Infestation Control Division. I am much impressed by the census-work, as described for example in the paper by Chitty and Shorten. I am sorry to say that in Holland we had bad luck with their technique, but I feel that in future it should be included in the normal routine of every rat campaign. Then results could be compared, and if the equipment were tried in many countries, more experience could be gained and if necessary adaptations could be discussed. All this would need coordination and collecting of data. I think that the Organisation, if requested, would be willing to give ample support to these desiderata.

This idea of support likewise came to me with regard to quite another subject, though still dealing with a rodent : the muskrat.

In Holland with our dykes we do not like such digging animals. Up till now we get them from the South but we could get them from other directions as well, for the problem of this migrating species exists in many countries. Interchange of data concerning incidence and control methods would be very useful. I know quite well that it might be questionable whether it should be the EPPO who should promote this coordination, as strictly spoken the muskrat is not an agricultural pest. I may refer, however, to the development which has been going on in those countries which now have an established control system. Practically always the agricultural people have started the thing. The same applies in the international field. I do not see any prospect of cooperation if the EPPO does not take the problem in hand, and therefore I am convinced that a request to this respect would be appropriate.

NOTE : In the discussion which followed Dr Caudri's reference to the muskrat it was agreed that as control of this animal was almost invariably undertaken by the Agricultural Departments of Governments, it was reasonable to regard the pest as coming within Schedule II of the Convention, and within the scope of the Organisation. The Conference passed a unanimous resolution recommending the Executive Committee to examine the position with a view to coordination of activities against the pest.

DORYPHORE

Aucun rapport n'ayant été présenté,
les notes suivantes donnent un résumé
des principales questions traitées au cours de la discussion.

A. **NOUVEAUX INSECTICIDES** (*HCH et Gammexane*)

Prof. Trouvelot (*Versailles*) se réfère au goût désagréable acquis par les pommes de terre à la suite de l'application de HCH. L'effet en est ressenti encore longtemps dans le sol. Il y a quelques années, des forêts avaient été traitées à l'HCH par avion ; une partie de l'insecticide tomba dans des champs de pommes de terre du voisinage et la récolte fut gâtée. En France, on déconseille d'utiliser l'HCH non purifié. Il existe maintenant dans le commerce un produit contenant du Gamma pur, mais l'orateur n'a pas de renseignements particuliers sur ce produit — qui semble toutefois avoir été utilisé en Espagne, en Allemagne et dans d'autres pays. Concernant le DDT, il a été constaté que l'effet toxique est irrégulier, particulièrement en cas d'application aux insectes adultes. Dans certains cas, l'efficacité n'aurait atteint que 50 % du taux normal.

Prof. Benlloch (*Espagne*) fait ressortir la complexité du problème.

En Espagne, le traitement a été appliqué onze fois à un même champ sans que les pommes de terre aient subi d'influence défavorable, tandis que dans un autre champ, les pommes de terre étaient gâtées après un seul traitement. Dans un autre cas, l'odeur continuait deux ans après l'utilisation de l'HCH. Il a été établi que le goût désagréable est dû à la présence dans l'HCH d'Heptachlorocychlohexane. L'orateur n'a qu'une confiance limitée dans le Gamma prétendu « pur ». A part la Maison Dupont, aux Etats-Unis, c'est une fabrique allemande qui possède la seule patente permettant de fabriquer du Gamma pur. Il existe dans le commerce un autre produit fabriqué en Espagne, qui contient un mélange de terpènes. Au sujet du DDT, il y a eu en Espagne, particulièrement l'an dernier, des cas dans lesquels ce produit est inefficace. Il est peut-être moins efficace dans les régions à climat chaud ; il y aurait là un problème qu'il vaudrait la peine d'étudier. Etant donné ces faits, il est à prévoir que le DDT perdra de sa popularité en Espagne.

Dr Koblett (*Suisse*) déclare que des expérimentations ont été exécutées en Suisse, sur ce problème, depuis 1946. Il a été constaté là aussi que dans des champs qui avaient été traités à l'HCH pour lutter contre les taupins et les vers blancs, des pommes de terre plantées deux ans après le traitement étaient gâtées. C'est pour cette raison que l'utilisation de l'HCH contre le doryphore a été interdite dans ce pays ; de plus, lorsque l'HCH est utilisé pour la lutte contre d'autres parasites, il est conseillé aux agriculteurs de ne pas planter de pommes de terre avant trois ans. Il faut se rappeler que les pommes de terre tarées ne sont pas seulement déplaisantes pour la consommation humaine, mais que si elles sont utilisées pour l'alimentation du bétail, d'autres produits, tels que

le lait, s'en trouvent affectés. En outre, il a été constaté que le DDT utilisé pour la lutte contre le doryphore permet d'obtenir de meilleurs résultats que l'HCH. Cette année, des expérimentations ont été entreprises avec les produits raffinés, mais les résultats n'en seront pas connus avant l'automne. L'orateur est d'accord avec le Prof. Benlloch pour reconnaître qu'il peut y avoir un certain danger à utiliser même des produits raffinés, et que des travaux d'expérimentation sont nécessaires avant qu'il soit possible de recommander leur utilisation dans la pratique.

Dr Drees (*Allemagne*) parle de l'utilisation d'un mélange d'HCH et de DDT, qui est courant en Allemagne. Les pommes de terre ne sont pas tarées et le mélange en question présente à la fois les avantages de l'action rapide de l'HCH et de l'action prolongée du DDT.

Prof. Melis (*Italie*) déclare qu'il y a un danger, même avec le Gamma pur. Des expérimentations ont été entreprises en Italie et se poursuivent en 1951. L'orateur n'est pas favorable à un mélange de DDT et HCH, qui présenterait des avantages et des désavantages. Des arrangements ont été conclus avec le Prof. Trouvelot pour que soient publiées chaque année dans le REDIA tous les renseignements concernant des expérimentations effectuées dans les pays du Sud.

B. PULVÉRISATIONS MIXTES CONTRE LE DORYPHORE ET LE MILDIOU

Dr Briejer (*Pays-Bas*) déclare qu'en Hollande, dans les régions où des pulvérisations intensives sont appliquées contre le mildiou, il est fréquent de les voir combinées avec la lutte contre le doryphore. Ce sont généralement les districts où le sol est constitué par de la vase de l'océan, dans le Nord et l'Ouest du pays, et les districts où l'on trouve du limon de rivière. Là où le sol est sablonneux ou tourbeux, soit dans le reste du pays, il n'est exécuté que peu ou pas de pulvérisations contre le mildiou, bien que l'équipement nécessaire soit disponible actuellement. Ceci est dû au fait que dans ces dernières régions, les variétés cultivées sont plus résistantes au mildiou. D'autre part, même pour les variétés sensibles, les pulvérisations ne semblent pas rentables ; même si le feuillage des plantes, en surface, est atteint par la maladie, les tubercules ne subissent que peu de dégâts. Il est évident toutefois que pendant les années où l'infestation par le mildiou est sérieuse (comme en 1950) le traitement des cultures serait utile.

La surface des cultures de pommes de terre, dans les régions où l'on pratique la lutte contre le mildiou, atteint environ 80.000 ha, mais une partie seulement de ce chiffre total pourrait entrer en considération pour des pulvérisations mixtes. Pour commencer, le nombre des traitements contre le mildiou (4-6) est beaucoup plus élevé que contre le doryphore (1-3). De plus, il est rarement nécessaire de lutter contre le doryphore au Nord de la Hollande, au Friesland et à Groningue, tandis que les variétés résistantes ne sont que peu ou pas traitées contre le mildiou. Par conséquent, les pulvérisations mixtes ne pourraient être envisagées que pour 40.000 ha de cultures.

Les avantages principaux des pulvérisations mixtes sont :

a) Une économie. (Le Dr Briejer démontre par des chiffres détaillés que pour la surface de 40.000 ha à laquelle il a fait allusion plus haut, l'économie atteindrait environ 80.000 livres sterling, ou 5-10 % du coût total de la lutte contre le doryphore et contre le mildiou aux Pays-Bas).

b) Une lutte plus intensive, car il y a tendance à appliquer un plus grand nombre de traitements contre le doryphore dans les régions où les traitements contre le mildiou sont habituellement exécutés. (La situation favorable, en ce qui concerne le doryphore, dans le Sud-Ouest de la Hollande, pourrait être due à ce fait).

c) Un avantage de moindre importance réside dans le fait que les cultures subissent moins de dégâts.

En opposition avec ces avantages, il faut citer le fait que lorsque l'on pratique des pulvérisations mixtes, existe le danger que le traitement ne soit pas appliqué à l'époque la plus favorable, aussi bien pour le doryphore que pour le mildiou.
Finalement, le Dr Briejer mentionne que le DDT, lorsqu'il est utilisé dans un mélange, devrait être plus concentré que pour être employé seul.

Dr Small (*Jersey*) déclare que les pommes de terre sont produites, à Jersey, dans un sol très fertile. Il s'est avéré nécessaire depuis plusieurs années d'appliquer des pulvérisations mixtes contre le doryphore et le mildiou. Le mélange utilisé est composé de poudre d'arséniate de plomb (33 %) à raison de 2.27 kg pour 100 gallons d'eau (1 gallon = 4 litres 54), additionnée d'oxyde de cuivre dans la même proportion, sauf pour la première puvérisation de l'année, pour laquelle la quantité de cuivre est réduite de moitié. L'orateur n'a pas connaissance des résultats détaillés de recherches de laboratoires sur l'efficacité insecticide du mélange, mais d'après les expériences faites en campagne, ces pulvérisations sont très efficaces. Comme le mildiou s'étend rapidement, il est nécessaire de pulvériser encore contre le mildiou, entre les traitements mixtes. Il est envisagé de changer l'arséniate de plomb, qui est un poison, contre le DDT avec lequel de bons résultats ont été obtenus ces dernières années. Dans ce but, des expériences ont été entreprises à l'aide de 25 % de DDT en poudre soluble, avec différents produits spécifiques du mildiou tels que l'acétate de cuivre, la bouillie bourguignonne, etc. La poudre de DDT étant ajoutée et utilisée de suite, il n'a jamais été constaté de brûlures ou de ralentissement de la végétation. Les jets des pulvérisateurs n'ont pas été bouchés non plus. En 1951, le produit utilisé sera : 50 % de DDT ajouté à de l'oxyde de cuivre. Ce mélange tout prêt est importé en récipients de 1/20 tonne. Comme il est difficile d'évaluer les besoins à l'avance, il sera intéressant de voir si le mélange se détériore pendant le stockage ou s'il subit une transformation chimique. L'expérience a déjà été faite de produit conservé pendant quinze mois, et encore en bon état au moment de son utilisation.

Dr Koblett (*Suisse*) déclare que les traitements au moyen de produits cupriques mélangés au DDT sont également de pratique courante en Suisse. Le produit généralement à disposition dans le commerce est le Gésacuivre. Il est d'accord avec le Dr Briejer pour reconnaître qu'il est souvent difficile de déterminer exactement quand il convient d'appliquer un traitement mixte.

Prof. Benlloch (*Espagne*) remarque que les produits combinés de cuivre et DDT sont connus en Espagne, mais rarement utilisés.

Dr Drees (*Allemagne*). En Allemagne, l'infestation doryphorique atteint 90 % et le mildiou est également un problème sérieux ; il faut trouver des traitements économiques. Ce qui suffit pour le doryphore n'est pas suffisant pour le mildiou. Il y a là un problème difficile à résoudre. L'agriculteur n'appliquera les traitements que s'il y trouve en définitive un avantage pour lui-même.

C. RAPPORT ANNUEL SUR L'INFESTATION DORYPHORIQUE EN EUROPE

Lors de la discussion sur l'utilité de ce rapport et la forme à lui donner, il est admis : 1° que cette publication est de valeur et devrait être poursuivie ; 2° que bien qu'il ne semble pas désirable d'imposer une uniformité de présentation pour les rapports des différents pays, le Directeur général aura à indiquer la longueur approximative qu'ils devraient atteindre.

Le Dr Koblett, parlant de la brièveté du rapport de la Suisse dans le volume de 1950, indique qu'un autre rapport traitant des expérimentations exécutées en Suisse au moyen d'un certain nombre d'insecticides avait été envoyé au CEZA et serait publié prochainement.

COLORADO BEETLE

No paper was presented.
The following notes summarise the main points made in the discussions.

A. **NEW INSECTICIDES** (*HCH and Gammexane*)

Professor TROUVELOT (*Versailles*) referred to the taint in potatoes due to the use of HCH. The effect remains a long time in the soil. Some years ago forests were treated with HCH by aircraft ; some of the insecticide fell on neighbouring potato fields, and the crops were tainted. The use of unpurified HCH is discouraged in France. There was now on the market a product containing pure Gamma, but he had no special information about it, though he thought Spain, Germany and other countries had. In regard to DDT, he mentioned that toxicity had been found to be irregular, especially with adult beetles. In some cases the efficiency had been only one half of normal.

Professor BENLLOCH (*Spain*) referred to the perplexity of the problem. In Spain, treatment had been applied to one field eleven times without tainting the potatoes, yet in another field taint resulted after only one treatment. In another case there was taint two years after HCH had been used. The bad taste had been found to be due to the presence of Heptachlorocychlorhexane in HCH. He had little confidence in so-called « pure » Gamma. He mentioned that apart from Dupont in the United States, a German firm had the only patent for making pure Gamma. There was another product on the market manufactured in Spain containing a mixture of turpenes. As regards DDT, he said that in Spain, especially last year, there were cases where this product was ineffective. Perhaps it was less efficient in hot climates ; this was a problem worthy of study. He thought that DDT would become less popular in Spain because of this.

Dr KOBLETT (*Switzerland*) said they had been experimenting on this problem in Switzerland since 1946. They too had noticed that in fields treated with HCH against wireworms and cockchafer grubs, potatoes grown two years after the treatment were tainted. For this reason the use of HCH against Colorado beetle was prohibited in his country ; moreover, where HCH was used against other pests, farmers were advised not to grow potatoes for three years after the treatment. It must be remembered that tainted potatoes were not only unpleasant for human consumption, but if fed to stock, other products, such as milk, were affected. Moreover, they had found DDT to give better results against Colorado beetle than HCH. This year they had started experiments with refined products, but the results would not be available until the autumn. He agreed with Professor Benlloch that there may be some danger even in the use of the refined products, and experimental work was necessary before these could be recommended for use in the field.

Dr DREES (*Germany*) referred to the use of mixed HCH and DDT in Germany, which was common. The potatoes were not tainted, and the mixture combined the advantage of the rapid action of HCH and the prolonged action of DDT.

Professor MELIS (*Italy*) said that even with pure Gamma there was some danger. Experiments had been carried out in Italy and were being continued in 1951. He did not favour a mixture of DDT and HCH ; there were advantages and disadvantages. He added that he had arranged with Professor Trouvelot to publish annually in REDIA all information concerning experiments in southern countries.

B. COMBINED SPRAYING FOR COLORADO BEETLE AND BLIGHT

Dr BRIEJER (*Netherlands*) said that in Holland, in those districts where spraying for Blight was carried out intensively, it was fairly often combined with Colorado beetle control. These were in general the sea-silt districts in the north and west of the country and the river-silt districts. On sandy soils or peat soils, that is, in the remaining part of the country, no, or only sporadic, spraying for Blight was done, though nowadays the necessary equipment was available. This was due to the fact that in these parts varieties were grown which were more resistant to Blight. On the other hand, even with the susceptible varieties spraying did not seem economic ; there was little damage to the tubers even if the aerial parts of the plants were diseased. However, in years with heavy Blight infestation (such as 1950) treatment of the crop would certainly be useful.

The area planted with potatoes in the « Phytophthora-control districts » was about 200,000 acres, but only a part of this total could be considered for combined spraying. First of all the number of treatments for Blight (4-6) was far higher than for Colorado beetle (1-3). In addition Colorado beetle control is seldom necessary in North Holland, Friesland and Groningen, whereas resistant varieties were not or were seldom treated for Blight. Consequently only 100,000 acres could be considered for combined spraying.

The main advantages of combined spraying were :

a) Economy. (Dr. Briejer gave detailed figures shewing that for the estimated area of 100,000 acres referred to above, the saving would amount to about £ 80,000, or 5-10 % of the total cost of Colorado beetle and Blight control in Holland).

b) More intensive control, since the tendency was to carry out more Colorado beetle treatments in areas where treatment against Blight was customary. (He thought it likely that the favourable Colorado beetle situation in the south-west of Holland was due to this factor).

c) A relatively minor advantage was that less damage was done to the crop.

Against these advantages must be set fact that where combined spraying was practised there was a danger that treatment was not carried out at the most favourable moment for either Colorado beetle or Blight.

Finally, Dr. Briejer mentioned that when used in mixtures the DDT should have a rather higher concentration than when used alone.

Dr. SMALL (*Jersey*) said that potatoes were grown in Jersey on very fertile ground. They have been compelled to use combined beetle and Blight spray for many years. The mixture used was lead arsenate powder (33 %), 5-lbs in 100 gallons water, plus copper oxide at the same rate, except for the first spray of the year when the amount of copper was halved. He had no detailed laboratory tests on the effect on the beetle, but judging by field experience, the spray was very effective. As Blight spreads so rapidly, it was also necessary to spray for Blight also between mixed sprays. They were thinking of changing from lead arsenate, which was poisonous, to DDT, owing to the good results obtained in recent years. With this in view they had experimented with 25 % DDT wettable powder, plus various proprietary Blight sprays, such as copper acetate,

Burgundy mixture, etc. DDT powder had been added and used at once and there had never been any scorching or slowing-up of growth. There had been no trouble with blocking of spray nozzles. In 1951 they would use 50 % DDT plus copper oxide. They were importing this mixture ready made in 1-cwt. drums. It would be interesting to know, as it is difficult to estimate requirements, whether this mixture deteriorates in store or whether any chemical action takes place. They had stored for 15 months and it was still in good condition when used.

Dr. KOBLETT (*Switzerland*) said that treatment with mixed copper products and DDT was also a general practice in Switzerland. The customary commercial product was Gésacuivre. He agreed with Dr. Briejer that it was often difficult to decide just when combined treatment should be carried out.

Professor BENLLOCH (*Spain*) said that combined copper and DDT products were known in Spain but rarely used.

Dr. DREES (*Germany*). In Germany there is 90 % Colorado beetle infestation and also bad Blight, and means must be found for economic treatment. What suffices for Colorado beetle does not suffice for Blight. It is a difficult problem. The farmer will only carry out such treatment if he sees an advantage to himself.

C. ANNUAL REPORT ON INCIDENCE OF COLORADO BEETLE IN EUROPE

Some discussion took place on the need and form of presentation of this report. It was agreed (1) that the publication was valuable and should be continued, (2) that while uniformity between the reports from the various countries was undesirable, some indication of the length of report to be aimed at should be given by the Director-General.

Dr. KOBLETT, in referring to the brevity of the Swiss report in the volume for 1950, pointed out that a further report, dealing with experiments carried out in Switzerland with a number of insecticides, had been sent to CEZA and would shortly be published.

NEMATODE DORÉ DE LA POMME DE TERRE
POTATO ROOT EELWORM

Dr F. H. Jacob (*England & Wales*),
Dr C. Foister (*Scotland*) and R. Chamberlain (*Northern Ireland*)

DISTRIBUTION GÉOGRAPHIQUE

THE GEOGRAPHICAL DISTRIBUTION OF THE POTATO ROOT EELWORM IN THE UNITED KINGDOM

(*Heterodera rostochiensis* Woll.)

Résumé. — *Les déclarations ci-apres ont pour objet l'état d'infestation de plusieurs pays d'Europe par le nématode doré de la pomme de terre.*

Pour l'Angleterre, le Pays de Galles et l'Irlande du Nord, les rapports donnent des détails sur les mesures appliquées pour remédier à la situation, et ils sont complétés par des cartes indiquant la distribution de l'infestation. En Irlande du Nord, existent déjà des dispositions législatives, et il apparaîtrait que, grâce à une activité vigilante au cours des cinq dernières années, les centres d'infection ont été pratiquement éliminés. En Angleterre et au Pays de Galles, on a donné jusqu'ici une importance principale à la propagande éducative intensive, mais l'introduction de dispositions législatives qui permettraient de prévenir la répétition trop fréquente de cultures de pommes de terre dans un même champ est à l'étude. Au Danemark, le nématode doré de la pomme de terre n'est pas considéré comme un danger pour l'agriculture, mais des échantillonnages et examens systématiques du sol sont exécutés dans l'intérêt des exportations, afin de donner la plus grande sécurité possible aux pays importateurs. En Irlande, le nématode doré de la pomme de terre n'a jamais été un parasite important, et son existence n'a pas été signalée dans les principales régions productrices de pommes de terre de semence. Selon les termes d'application de la loi d'Etat pour les pommes de terre de semence qui doivent être accompagnées de certificats, il est prévu qu'aucun certificat ne peut être établi pour des cultures qui présenteraient la moindre indication de la présence de nématodes. L'Ile de Jersey souffre du parasite, qui s'attaque également aux cultures de tomates. Le délégué espagnol déclara que le nématode doré de la pomme de terre n'existe pas en Espagne, mais qu'on ne peut pas dire que ce nématode n'est pas susceptible de causer des dégâts importants dans les régions méditerranéennes. Le nématode doré n'a pas été trouvé en Norvège et dans la Sarre ; en Finlande il a été trouvé pour la première fois en 1946, mais l'étendue de l'infestation est très limitée.

The first record of the Potato Root Eelworm in the United Kingdom was in Scotland in 1913. In 1917 it was recorded in northern England. Since then, scientific workers in the United Kingdom have undertaken considerable research into the ways in which it can be prevented from spreading, and from increasing in intensity, and its economic importance is fully realized. Surveys have been made in order to assess its occurrence in the main potato growing district, and also to assess the financial loss which can be attributed to it. In addition to the results of special surveys

information about the geographical distribution of Potato Root Eelworm has been obtained in the following ways :

1. As the result of the routine advisory work carried out by officers of the Ministry of Agriculture and Fisheries, the Department of Agriculture for Scotland and the Ministry of Agriculture of Northern Ireland.
2. From the systematic examination of growing crops, as in the inspection for seed potato certification, e.g. since 1945 seed potato inspectors in Scotland have had to lift and examine the roots of a random sample of plants in each field which they inspect.
3. From the results of soil sampling done in connection with (*a*), seed potato certification, and (*b*), nursery inspections resulting from recent U.S.A. quarantine requirements.

Since 1946 all fields in Northern Ireland in which it is intended to grow the highest grades of seed potatoes, have had to satisfy a stringent soil sampling test. A similar requirement, involving the highest grade only, has been operated in England and Wales since 1949, and is now being operated in Scotland.

England and Wales

The accompanying map shows the geographical distribution of Potato Root Eelworm on a field scale : it is based upon detailed enquiries made in 1949. The map does not indicate the extent to which the pest occurs in market gardens, private gardens and allotments. Such holdings are known to be badly infested in most parts of the country. In market gardens, tomatoes grown under glass are sometimes badly infested.

The shaded portions of the sketch map correspond very closely to the principal ware potato growing districts. To a smaller extent they include districts which specialise in early potatoes. The factor common to these areas is undoubtedly over-cropping. However, not all fields or even farms in the shaded areas are infected with P.R.E. There is also a considerable variation in the degree of infestation. For instance in the worst districts about half the total infected area is only slightly infected. In the most extensive area the slightly infested area is about two thirds of the whole.

We would also like to make it clear that the main seed potato growing districts are well isolated from the infected ware potato districts. The highest grades of seed potatoes may only be grown in districts which satisfy certain conditions of altitude and climate. In the main such districts are those in which the system of agriculture is based upon sheep and cattle rearing, and there is therefore no tradition of arable farming, and no tendency to overcrop with potatoes. As a rule potatoes are grown only once every six or seven years, or the rotation may be even longer, depending on the length of time the fields are left in grass. In none of these districts has P.R.E. ever been found in sufficient numbers to result in obvious potato sickness. Soil sampling in seed potato areas is likely to be extended ; at present the limiting factor is manpower.

We have said that private gardens and allotments are infected throughout the country : this is true of the seed potato districts. Such sources of infection, however, tend to be concentrated near towns and villages, and are much less numerous in rural areas. The dangers involved in this are fully understood. There is no legislation to deal with this problem, but we are fortunate to have an efficient Advisory Service which by educational means keeps farmers alive to the dangers involved.

We would like to stress the educational nature of our approach to the problem in the ware potato districts. There is a tendency on the part of farmers to move from badly infested districts to new ones. One of the new districts is a part of S. E. England known as Romney Marsh. The Advisory Officer responsible for this district has initiated a comprehensive programme of soil sampling in order to detect any incipient centres of infection. He is also actively concerned to keep farmers informed of the dangers of over-cropping.

POTATO ROOT
EELWORM
1949

PLANT PATHOLOGY LABORATORY
HARPENDEN

The more progressive farmers are now very well aware of the need to take measures to prevent the P.R.E. problem from becoming worse. For a number of years we have considered the introduction of legislation designed to prevent over-cropping with potatoes, but the need for food during the war and since has made it impossible to reduce the total potato acreage. The desirability of such legislation is now being considered again. The difficulties are very great, and it is expected to take several years to implement a satisfactory system. We already have legislation to deal with the Sugar beet eelworm, *Heterodera schachtii*, but this problem is not so difficult because all sugar beet is grown by contract with the beet sugar factories, and because it was possible to introduce legislation before the problem became widespread or severe.

The method of soil sampling used in connection with statutory duties has been described in the Report of the Quarantine Working Party which met in February. It is sufficient to say that it has been planned as the result of very careful thought and careful experimentation. It is designed to detect populations much smaller than would give rise to visual symptoms on the potato plant.

Scotland

It is known that there are heavily infested fields in the early potato growing districts of south-west and eastern Scotland, and that gardens and allotments are infested in most parts of the country, particularly near the large towns. It is also known that infestation occurs in a few districts where seed potatoes are grown on an intensive scale. Recent work however, suggests that only a small proportion of the total area under seed potatoes is involved.

Northern Ireland

In Northern Ireland, Potato Root Eelworm has been a notifiable pest since 1945, when the Potato Root Eelworm (Northern Ireland) Order came into operation. Under the terms of this order, it is compulsory for every person who grows potatoes or tomato plants on land which is infected or suspected to be infected with Potato Root Eelworm to notify the fact to the Ministry of Agriculture. In cases where the presence of the Eelworm is confirmed the Ministry prohibit the growing of potatoes or tomatoes on the infected land, the removal of soil from the infected land, and the removal of vegetables, weeds, or plants to the roots of which any soil adheres. In the case of glasshouse infections, compulsory steam sterilization of the soil is prescribed, or compulsory resoiling under the supervision of the Ministry's officers.

A large scale investigational programme relating to the incidence of Potato Root Eelworm in Northern Ireland has been in progress for over five years, and from the large volume of data already to hand, it is quite evident that this country enjoys a remarkable degree of freedom from the pest. Soil samples from over 70,000 fields or parcels of land, amounting to upwards of 150,000 acres, have already been examined in the laboratory. These samples were taken from all kinds of premises which collectively represent a comprehensive cross-section of the agricultural land of the entire province ; they include samples from gardens, allotments, nurseries and all types and sizes of farm holdings engaged in vegetable growing, seed potato producing, general mixed farming, etc.

The main work, however, has been focussed on those farms in the seed potato producing areas and on premises in a few localized districts where more intensive cropping with potatoes has been practised and where a higher incidence of Potato Root Eelworm might be expected. The findings have been that less than 3 % of all the samples proved to be infected, and that in the majority of these cases the attack was in the incipient stages (i.e. not detectable except by soil sampling) and was chiefly confined to gardens and allotments. The relatively small number of field cases recorded were for the most part concentrated in a few localized areas remote from the main seed potato producing districts (as indicated in the accompanying map). All cases of infection (whether field or garden), as soon as detected, have been neutralized as sources of infection by the compulsory measures applied under the Order.

NORTHERN IRELAND

(Scale 12 miles to 1 inch)

Main Seed Potato areas shown thus

Areas where Potato Root Eelworm found in fields shown thus

It is evident that one important factor minimising the spread and establishment of Potato Root Eelworm is the wide rotation normally practised over the greater part of Northern Ireland, where potatoes are included in the rotation not oftener than once in 6 or 7 years. It is estimated that by the end of 1952 (when the large-scale soil-sampling survey has been in operation for a minimum of 7 years), practically every field on every seed potato producing farm in Northern Ireland will have been soil-sampled.

Since 1945, the following schemes have entailed routine annual soil sampling of the different holdings concerned :

1 *Certification of Seed Potatoes.* All the higher grades of seed potatoes, in order to qualify for a certificate, must be grown on land where the soil has been sampled and found after laboratory examination to be free from Potato Root Eelworm.

2 *Soil-sampling of Nurseries.* All nurseries desiring to engage in the sale of plants for transplanting off the premises, require to have the ground intensively soil-sampled and freedom from Potato Root Eelworm confirmed.

3 *Soil-sampling of premises raising Brassica plants.* All fields and plots where Brassica plants are grown for the purpose of transplanting and disposal off the premises must be similarly soil-sampled and declared free from Potato Root Eelworm.

4 *Soil-sampling in Special areas.* In those few small areas where, in the past, close cropping with potatoes has been practised, the planting of potatoes for any purpose (seed or ware) is now permitted only in those fields which are first soil-sampled and found to be free from Potato Root Eelworm.

DENMARK

Dr P. Bovien

Government Laboratory, Lyngby

Potato Root Eelworm was found in Denmark in 1928. Since then the presence of the nematode has been ascertained in many parts of the country, but real damage has only been reported from small gardens where potatoes are grown year by year or with very short intervals. On farms where a reasonable seed rotation is applied no damage has occurred, but this does not necessarily mean that the nematode is entirely absent from such lands. We do not regard the potato eelworm as a menace to Danish agriculture, but for the sake of our export trade we want to know as much as possible about the distribution of the nematode, especially in soils where seed potatoes, bulbs, etc. are grown. We have recently started a qualitative examination of soil samples from such fields. As our personnel is very limited the work proceeds, however, rather slowly. We are trying to find out which method we can use with the best results under our conditions. The sampling has not yet been fully standardized, but samples are collected at random over the field during the growing season.

Our work is thus still in the experimental stage, but the results hitherto obtained are reassuring as we have found a very few cysts only in a very few fields. I feel convinced that the potato root eelworm is really a very rare phenomenon *outside the small gardens mentioned* and I venture to say that the risk of introducing this pest with potatoes, flower bulbs and nursery products from Denmark is almost negligible. Nevertheless we will go on with the soil examinations in order to give the importing countries the best possible security.

IRELAND

Mr D. Delaney

Department of Agriculture, Dublin

The Potato Root Eelworm has never been a serious pest in this country and we are fortunate that in the principal seed potato growing districts the pest is not known to exist. This satisfactory condition is due largely to the fact that farmers in these areas adopt wide rotations which ensure that potatoes are not grown too frequently in the same soil.

Important research work dealing with Potato Root Eelworm has been carried out in this country by Dr. J. Carroll of the Entomology Department of University College, Dublin. During recent years the Department of Agriculture, in conjunction with the Entomology Department of University College, Dublin, have provided a Soil Testing Service to ensure that the seed potato growing areas remain free from the Eelworm pest. It has long been the regular practice under our Seed Potato Certification Scheme to insist that no crop will be certified which shows any evidence of the presence of Eelworm. Sampling of the entire area devoted to seed production has not yet been completed but the survey to date indicates that the seed-growing districts are singularly free from the pest. Land in which bulbs and plants intented for sale are grown is also sampled and tested for freedom from Eelworm.

JERSEY

Dr. Small said that Potato Root Eelworm was first discovered in Jersey in 1938. It attacks both tomatoes and potatoes. A systematic survey was immediately started, when war intervened, but it had already shewn that infestation in some areas was of long standing. The systematic survey was abandoned, and reliance is now placed on requests from farmers to examine their land. It is estimated that one-tenth of the number of cultivable fields in the island have been surveyed. In certain coastal areas where land values are very high, the farmer cannot afford to adopt rotation of crops, and infestation is very serious, yield having sometimes been 1 instead of 15 tons per acre. Where rotation is practiced, infestation is less. « Volunteer » potatoes are a definite danger.

SPAIN

Professor Benlloch said that Potato Root Eelworm does not exist in Spain, but the possibility of this pest causing serious damage in Mediterranean areas could not be ruled out.

SAAR

Dr. Leib said the potato eelworm had not yet been found in the Saar, but as the pest had been reported in nearby regions (in Holland and France) special attention was being given to it.

FINLAND

The eelworm was discovered for the first time in 1946 in a village about 40 miles north of Helsinki. About 50 small plots have been found to be infested. In spite of surveys, infestation has not been detected elswhere.

NORWAY

The eelworm has not yet been found in Norway.

LE POU DE SAN JOSÉ

Les échanges de vues à ce sujet furent limités à deux aspects : la lutte sur place et la fumigation des plantes récoltées

Dr. DREES (Allemagne)

Lorsque le pou de San José fut découvert pour la première fois en Allemagne occidentale, en l'année 1946, il fallait se douter qu'il se trouvait déjà plus largement répandu. Afin d'obtenir une image exacte de l'étendue de l'infestation, un service d'inspection fut organisé, qui avait pour tâche d'examiner les pépinières et les vergers. Ce service a été placé sous la direction des Services de la Protection des Plantes. L'inspection des plantes est exécutée par des techniciens spécialisés, qui sont aidés dans leur tâche par un certain nombre d'autres personnes — principalement des étudiants. Pendant l'année 1950, 121 techniciens de la Protection des Plantes et 872 inspecteurs se sont consacrés à ce travail.

Ce sont en premier lieu les jeunes arbustes et arbres de pépinières qui sont soumis à l'inspection, car le pou de San José se répand principalement sur les plantes de pépinières. Cette inspection doit être très méticuleuse. Les inspecteurs en charge, qui sont équipés de loupes, prennent des échantillons d'arbres et d'arbustes suspects d'infestation. L'examen microscopique permet ensuite un diagnostic précis. L'inspection minutieuse d'une pépinière ayant environ 0,5 ha de surface représente cinq à six jours de travail pour l'inspecteur.

Le service d'inspection des jeunes plantes a été financé par le Gouvernement fédéral, et il a largement prouvé son utilité. La plupart des nouveaux foyers d'infestation, sur 139 qui ont été découverts en 1950, l'ont été par ce service.

Comme il y a lieu de croire que de nombreux foyers additionnels d'infestation n'ont pas encore été découverts — en particulier par suite de l'importation dans le courant de l'année dernière, de plantes de pépinières infestées, — de nouveaux inspecteurs ont été recrutés. Cela permet au service d'inspection d'étendre les examens aux jeunes arbres jusqu'à 10 ans d'âge. De plus, dans chacun des bureaux de la Protection des Plantes, un expert se consacrera à la lutte contre le pou de San José, et à la surveillance générale des inspections.

Des concentrations de 5 à 8 % de carbolineum (pour arbres fruitiers) et de mélanges de carbolineum et de dinitrocrésol ont été principalement utilisés pour des pulvérisations d'hiver dans les régions infestées. Environ 51.600.000 litres de liquide ont été pulvérisés.

En été, le produit le plus employé pour les pulvérisations est l'ester phosphorique, tel que E 605 fort, à une concentration de 0,1 %. Les résultats obtenus, grâce à l'utilisation de cette forte concentration de produits E, sont bons.

Fumigations

Jusqu'ici, le moyen le plus efficace qui ait été employé pour combattre le pou de San José sur les plantes de pépinières consiste en des fumigations à l'acide cyanhydrique. Sur le territoire de la

Confédération allemande, ce procédé est appliqué dans les stations phytosanitaires, à la frontière, aussi bien qu'à l'intérieur du pays pour les produits de pépinières qui circulent sur les marchés allemands.

Le Service officiel de l'Inspection des Plantes exécute les fumigations de plantes importées aux stations-frontières. Nous faisons une distinction entre les importations provenant de pays infestés par le pou de San José, et celles provenant de pays non infestés. Des instructions ont été données, prescrivant de faire passer à la fumigation toutes les plantes et parties de plantes dycotylédons en provenance de pays infestés car la liste des plantes-hôtes du parasite n'a pas été encore clairement établie. Tenant compte de l'effet nuisible de l'acide cyanhydrique, nous nous sommes abstenus de pratiquer la fumigation des arbres à feuilles persistantes et des fleurs coupées. En dépit du traitement à l'acide cyanhydrique, il est obligatoire de soumettre les fruits à l'inspection.

La destruction des parasites qui sont importés avec des produits de pépinières s'effectue dans des cabines de fumigation fixes ou temporaires au lieu de passage de la frontière. Des wagons de chemin de fer, imperméables aux gaz, et des bâches imperméables à l'air, qui peuvent être placées sur les wagons, sont utilisés comme installations improvisées pour les fumigations.

Tous les produits de pépinières vendus dans la plupart des districts de la Confédération doivent avoir passé à la fumigation. Tout article ainsi traité est pourvu d'une étiquette spéciale du Service Allemand de la Protection des Plantes. En conséquence, une certaine quantité d'entreprises de fumigation ont été mises sur pied dans le centre des régions où se trouve le plus grand nombre de pépinières. De plus, les cabines de fumigation mobiles se sont révélées utiles, car elles évitent aux propriétaires de pépinières d'avoir à payer des frais de transport.

Au cours de la fumigation, il convient de veiller à ce que les produits de pépinières ne soient pas compressés ou emballés dans des matériaux humides. La température devrait être au-dessus de zéro dans la cabine de fumigation. La densité la plus appropriée, pour le gaz, se place entre 7,5 et 10 grammes de HCN par mètre cube, selon le degré de dissémination et la vitesse de développement des gaz. Le personnel chargé d'exécuter les fumigations est fourni par les Services de la Protection des Plantes ou par des firmes et agences techniques autorisées. En général, la stricte observance des règlements de sécurité permet de prévenir des accidents.

Divers procédés de fumigation ont été expérimentés,

1. Il est possible d'ouvrir à partir de l'extérieur un récipient contenant du gaz, que l'on introduit dans la cabine. Toutefois, ce procédé n'est pas sûr et la dissémination des gaz n'est pas uniforme.
2. L'utilisation de tablettes de Calcide a donné satisfaction ; toutefois, le personnel exécutant peut courir un certain risque pendant qu'il s'occupe de moudre les tablettes.
3. Le procédé qui consiste à faire circuler les gaz a été reconnu comme le meilleur. Un chauffage préalable accélère la formation des vapeurs et elles se disséminent rapidement et de manière uniforme.

Au sujet du volume que doivent avoir les cellules de fumigation, on peut dire qu'un espace d'environ 100 m^3 permet le meilleur résultat, mais demande en même temps la plus importante consommation de gaz. Le volume minimum de cabines de fumigation, où des wagons peuvent se décharger, est d'environ 60 m^3.

Les cellules fixes dans lesquelles peuvent entrer des charrettes représentent la plus importante dépense de matériel. Des cabines fixes plus petites reviennent moins cher quant à leur construction, mais elles entraînent des frais de main-d'œuvre élevés car il est nécessaire d'y transporter les plantes. Les cabines de fumigation transportables se sont révélées utiles dans les pépinières très clairsemées, pour lesquelles il faut ajouter aux frais d'exécution du traitement les frais de la consommation en combustible.

Enfin, au point de vue financier, nous pouvons donner les chiffres suivants :

volume de la cabine	coût initial	coût de la fumigation par plante	coût de l'HCN par fumigation
100 m³ (*installation fixe pour charrettes*)	11.632 DM.	2,9 Dpf.	5,10 DM.
60 m³ (*Fixe*)	—	2,5 —	6,80 —
18 m³ (*Ambulante*)	5.857 DM.	2,5 —	1,89 —

(*à l'exclusion des frais de transport*)

SAN JOSÉ SCALE

The discussions on this subject were limited to two subjects : control in the field, and the fumigation of harvested plants.

Dr DREES (Germany)

When in 1946 the San José Scale was first detected in West-German territory, it had to be assumed that it might have spread further. In order to obtain a clear picture of the extent of infestation a field inspection service was established for investigating plant nurseries and orchards. It was the responsibility of the Plant Protection Office to supervise this service. The field inspection service is carried out by trained technicians assisted by others, mainly students. In 1950, 121 plant protection technicians and 872 field inspectors were entrusted with this responsibility.

For the most part young stocks and tree nurseries are examined by the field inspection service since the San José Scale was especially disseminated through tree nursery material.

The inspection must be carried out meticulously. The field inspectors, equipped with magnifying glasses, take samples from trees and bushes suspected of being infested. Microscopical tests give an exact diagnosis. The thorough inspection of a tree nursery of an area of about one acre means 5-6 days work for the inspector.

The field inspection service has been financed by the Federal Government. Its establishment has been fully justified. The majority of newly discovered infestation centres in 1950 out of a total of 139 were found by this service.

Since there is a suspicion that a number of additional San José scale centres have not yet been discovered, in particular after the importation of infested tree nursery material last year, an additional number of inspectors have been recruited. This enables the service also to extend examinations to include trees up to 10 years old. Moreover a scientist at each Plant Protection office will be allocated to the task of controlling San José scale and supervising the inspections.

Fruit tree carbolineum and mixtures of carbolineum with Dinitro-cresol at a 5-8 % concentration were mainly used for winter spraying in infested areas. Roughly 11.5 million gallons of liquid were sprayed.

In summer the principal spray material is phosphoric acid ester, such as E 605 forte of a 0.1 % concentration. The results of using E preparations of this strong concentration are good.

Fumigation

So far the most effective medium for controlling San José Scale in nursery stocks is by fumigation with Prussic Acid. In Federal Germany this is carried out at the border quarantine stations as well as in the interior for nursery material marketed in Germany.

The official German plant inspection service carries out the fumigation of imported plants at the frontier stations. We distinguish between imports from San José infested and non-infested countries. Instructions have been issued to fumigate all live dicotyledonous plants and plant parts imported from infested countries, since the number of host plants of the pest is not yet clearly established. On account of the damaging effect of Prussic Acid we have abstained from fumigating evergreen plants and cut flowers. Notwithstanding a treatment with Prussic Acid, it is obligatory to submit fruit for inspection.

The destruction of pests in imported tree nursery material takes place in stationary or temporary fumigation chambers at the places of entry. Gastight railway trucks and airtight tarpaulins, which may be placed over the trucks, are used for make-shift fumigation.

All tree nursery articles marketed in the majority of the federal lands must be fumigated. Each article gassed is marked with a label from the German Plant Protection Service. Consequently several fumigation plants have been established in the heart of the large tree nursery districts. Also mobile fumigation chambers have been valuable since they save transport costs to the owners of tree nurseries.

During the fumigation process care must be taken that tree nursery material is not tightly pressed or packed with moist wrappers. The temperature in the fumigation chamber should be above freezing point. The most appropriate density of the gas is between 7.5 and 10 grams HCN per cu. metre, depending on the dissemination and the speed of development of the fumes.

The operational staff in the federal area is made available by the Plant Protection Offices or by licensed firms and technical agencies. In general accidents can be prevented through a strict observance of safety regulations.

Various fumigation processes have been tried.

1. One can open a gas container from the outside and have the fumes enteing the chamber. However, this process is unreliable and there is no uniform dissemination of the fumes.
2. The use of Calcid tabloids proved satisfactory, although there may be danger to the workers while the tabloids are being ground.
3. The fume circulation process has proved the best. A pre-heater accelerates the dose of fumes, and dissemination takes place quickly and uniformly.

As far as the size of the fumigation plants is concerned it may be said that a space of about 100 cu. metres gives a maximum performance, but at the same time requires a maximum consumption of fumes. The minumum size of fumigation plants which can be filled from waggons is about 60 cu. metres.

Stationary plants in which vehicles can move have the largest material expenses. Smaller stationary plants are initially cheaper but involve high operational costs on account of the shifting of trees. Mobile fumigation chambers have proved their worth for widely scattered tree nurseries, for which one has to add fuel consumption to the operational costs.

Finally as regards finance :

size of plant	initial cost	costs of fumigation per tree	cost of HCN per fumigation
100 cu. metres (*stationary for carts*)	11,632 DM.	2.9 Dpf.	5.10 DM.
60 cu. metres (*stationary*)	—	2.5 —	6.80 —
18 cm. metres (*mobile*)	5,857 DM.	2.5 —	1.89 —
	(*excluding transport*)		

M. G. MATHYS (Inspecteur, Station Fédérale de Recherches, Lausanne)

présenta un rapport sur les recherches sur les méthodes de fumigations des végétaux en Suisse. Le rapport était illustré de projections lumineuses. Un résumé du rapport est donné ci-dessous. Copies du texte complet peuvent être fournies sur demande.

L'auteur décrit en détail de longues séries d'expériences exécutées en Suisse depuis 1946, afin d'établir quelles sont les meilleures conditions de fumigation à l'HCN, non seulement dans les cabines de fumigation fixes qui sont installées aux principaux postes frontières, mais également au moyen de cellules ambulantes qu'il est possible de déplacer à l'intérieur du pays, afin de traiter des vergers et des plantes de pépinières destinées à l'exportation.

Les expériences faites dans une cabine d'expérimentation de 3 m^3 de volume, et confirmées ultérieurement dans les cabines de fumigation installées à la frontière, dont le volume est de 30 m^3 et de 100 m^3, furent exécutées sur des pommiers et sur d'autres arbres fruitiers. Elles démontrèrent que l'application pendant quinze minutes d'une dose d'HCN correspondant à 8 gr de cyanure de sodium par mètre cube (4 gr HCN/m^3) entraîne la destruction du pou de San José à tous ses stades de développement, ceci en cabines absolument étanches, sans que les plantes subissent de dégâts. Au cours de ces expériences, 14.500 plantes subirent des fumigations.

Il est admis que les fumigations à raison de 5 gr de HCN par mètre cube pendant une durée maximum de trente minutes, offriraient une bonne marge de sécurité, quel que soit l'état des plantes traitées, et ceci plus particulièrement parce que presque tous les insectes vivants, en hiver, se trouvent être des larves au premier stade de développement, qui sont détruites à la concentration de 2,5 gr d'HCN par mètre cube.

Les résultats suivants figurent parmi les plus importants qui aient été acquis à la suite des expériences en question :

1. La génération de l'acide cyanhydrique par le procédé du pot offre dans la pratique des avantages incontestables, compensant largement les inconvénients inhérents à la méthode.
2. La vitesse de génération de l'acide cyanhydrique par ce procédé ne se trouve pas modifiée de façon sensible à basse température lorsque l'acide sulfurique est mélangé à l'eau au moment de la mise sous gaz.
3. Les variations de l'hygrométrie ambiante n'exercent aucune influence sensible sur l'efficacité des fumigations entre 60 et 100 % d'humidité relative.
4. Au delà d'une exposition critique de dix minutes suivant l'introduction du gaz dans la cellule, le temps pendant lequel le gaz agit sur les cochenilles cesse d'influencer de façon

significative l'efficacité coccicide particulière des différentes doses initiales de HCN, dans les conditions étudiées.

5. La présence d'un film d'eau sur les végétaux traités ne diminue pas l'efficacité des fumigations aux concentrations léthales.
6. La présence d'une croûte de terre sur les végétaux traités ne diminue pas l'efficacité des fumigations aux concentrations léthales.
7. Un préconditionnement de plusieurs heures à température élevée paraît augmenter la sensibilité au gaz du pou de San José.

La fumigation sous bâches semi-perméables de végétaux en pleine terre implique la solution du problème posé par :

a) l'étanchéité incomplète de l'enveloppe que l'on peut compenser par l'élévation systématique des doses théoriques initiales.

b) l'impossibilité d'engager un système de brassage mécanique de l'atmosphère mais qui est néanmoins réalisable par l'introduction de deux sources génératrices de gaz dont l'une recouverte d'un diaphragme placé à 20-30 cm du bord supérieur du pot sert à créer une atmosphère toxique dans les parties inférieures du volume, alors que l'autre, démunie de ce diaphragme, assure la répartition du gaz dans la partie supérieure.

La dose léthale de gaz pour le pou de San José fumigué sous bâche s'élève à 40 gr HCN/m³ répartie en deux pots dont l'un recouvert d'un diaphragme doit émettre 25 gr de HCN/m³, alors que l'autre, libre de chicane, en produira 15 gr par mètre cube.

Dans des recherches sur l'effet de la fumigation coccicide HCN sur la végétation des sujets traités, nous n'avons pas pu déceler un symptôme typique de dommage provoqué par le gaz. Si dans certains cas il y eu à déplorer de mauvaises reprises des végétaux fumigés, nous devons en attribuer la cause aux conséquences indirectes de la désinsectisation.

M. G. MATHYS (Inspector, Federal Experimental Station, Lausanne)

Presented a report on research into plant fumigation methods in Switzerland. The report was illustrated with lantern slides. A brief summary is given below. Copies of the full report can be supplied on request.

The author described in detail the long series of experiments carried out in Switzerland since 1946 to find the best conditions for fumigation with HCN, not only in the fixed fumigation plants at the main frontier stations, but with mobile plants in the interior of the country, for dealing with orchards and with nursery stock for export.

Experiments carried out in an experimental chamber of 3 cu. metres, and later confirmed in the frontier chambers of 30 cu. metres and 160 cu. metres, both on apples and other kinds of fruit trees, shewed that the application for 15 minutes of a dose of HCN corresponding to 8 g sodium cyanide per cu. metre (4 g HCN/cu. metre) ensured the destruction of all stages of development of San José Scale in hermetically-sealed chambers, without injuring the trees. In the course of the experiments, 14,500 trees were fumigated.

It is considered that fumigation at the rate of 5 g HCN per cu. metre for a maximum period of 30 minutes would offer a safe margin of security, whatever the condition of the plants being treated, especially as almost all the insects living in winter are first-stage larvae which are destroyed by a concentration of 2.5 g HCN per cu. metre.

The following is a summary of the main results of the experiments :

1. Generation of the hydrocyanic acid by the « pot process » offers in practice undeniable advantages, which largely compensate for the inherent disadvantages of the method.

2. The speed of generation of the hydrocyanic acid by the process is not noticeably affected in low temperatures when sulphuric acid is mixed with water at the moment of the application of the gas.
3. The variations in the surrounding humidity exercise no appreciable influence on the efficiency of fumigations between 60 and 100 % of relative humidity.
4. Beyond a « critical » application of 10 minutes, following the introduction of the gas into the chamber, the time during which the gas acts on the Scale insects ceases to influence in a significant manner the particular insecticide efficiency of the different initial doses of HCN in the studied conditions.
5. The presence of a film of water on the treated plants does not decrease the effectiveness of fumigation at lethal concentrations.
6. The presence of a covering of earth on the plants treated does not decrease the effectiveness of fumigation at lethal concentrations.
7. A preconditioning of several hours at high temperature seems to increase the sensitivity of the San J. Scale to the gas.

The fumigation under semi-permeable sheets of plants in full growth raises the following problems :

a) The incomplete airtightness of the envelope. This can be compensated by the systematic raising of the theoretical initial doses.

b) The impossibility of engaging a mechanical mixing system. This can be remedied by the introduction of two gas generating sources, one of which is covered by a diaphragm placed 20-30 cms. from the top edge of the pot, serving to create a toxic atmosphere in the lower parts of the volume, while the other, with no diaphragm, ensures the distribution of the gas in the upper part.

The lethal dose of gas for the San José Scale fumigated under canvas is 40 g HCN per cubic meter spread over 2 pots, of which the one covered with a diaphragm gives 25 g HCN per cubic meter and the other, with no deflector, produces 15 g per cubic meter.

In research on the effect of insecticide fumigation of HCN on the vegetation of the plants treated, we have found no typical symptom of damage provoked by the gas. If in some cases there was imperfect vegetation of the fumigated plants, we must attribute the cause to indirect consequences of the disinfection.

M. R. VASSEUR (*Station Centrale de Zoologie Agricole, Institut National de la Recherche Agronomique, Versailles*)

présenta un rapport, dont ce qui suit est le résumé, sur les résultats des recherches faites en France sur certains aspects de la biologie du Pou de San José, et la lutte contre ce parasite.

L'étude du Pou de San-José (Quadraspidiotus perniciosus Comst.) en France, commencée en 1940 dans la région de Cannes-Mandelieu (Nepveu) et poursuivie ensuite dans le Lyonnais et dans quelques foyers moins importants situés plus au nord (Vasseur) a été axée principalement sur les questions suivantes :

1. Biologie de l'insecte en relation avec les conditions climatiques.
2. Contaminabilité des diverses espèces végétales de la flore cultivée et spontanée.
3. Procédés de lutte.

Les observations bio-écologiques montrèrent que le Pou de San-José a de trois à quatre générations annuelles dans le Midi de la France, deux générations complètes et une troisième partielle et facultative dans le Lyonnais et deux seulement à Nevers et à Bourges. Toutefois, les dégâts causés par l'insecte ne semblent pas toujours être en proportion directe avec le nombre de généra-

tions par an. Avec deux générations annuelles, les dommages sont souvent presqu'aussi graves que dans le Midi où leur nombre est à peu près double. Ceci paraît pouvoir s'expliquer, en partie tout au moins, par la mortalité estivale élevée des larves, beaucoup plus forte dans les régions à climat chaud et par les conditions d'hibernation. En effet, dans le Lyonnais et dans les foyers se trouvant plus au nord le Pou de San-José hiverne exclusivement à l'état de larve du premier âge, stade très résistant au froid alors que plus au sud les populations hivernantes sont moins homogènes et comprennent aussi d'autres stades évolutifs, larves du deuxième âge et adultes qui sont beaucoup plus sensibles aux variations de la température. Il apparaît donc que le Pou de San-José est un insecte plus particulièrement adapté aux régions de climat tempéré, correspondant approximativement aux zones de cultures du Pêcher et du Poirier. En cas d'extension du parasite, des dommages importants seraient à craindre partout où les conditions climatiques lui permettraient d'avoir deux générations annuelles complètes. D'après les exigences écologiques de l'insecte, ceci serait le cas à Clermont-Ferrand, Le Mans, Strasbourg et Nancy par exemple, en Allemagne du Sud (Wurtemberg, Bavière) et dans la plupart des pays de l'Europe centrale. Par contre, il n'y aurait qu'une génération par an dans le Nord de la France (Lille), dans la région de Hambourg et au Danemark où, par conséquent, le danger à envisager serait moins grave.

En ce qui concerne la contaminabilité des diférents végétaux, des listes assez détaillées ont été publiées récemment (1,2). Il est à noter, cependant, que ces listes quoique résultant d'observations et d'expériences précises et nombreuses ne peuvent avoir de valeur absolue et ne doivent être considérées que comme des éléments de base. Pour une même espèce végétale, le degré de contaminabilité peut être différent sous d'autres climats et il peut varier également suivant l'état physiologique de la plante.

Durant ces dernières années, de nombreux insecticides divers ont été expérimentés dans la lutte contre le Pou de San-José. Les résultats les meilleurs ont été obtenus avec les émulsions d'huiles de pétrole utilisées seules ou en mélange avec d'autres insecticides tels que le di-nitro-ortho-crésol par exemple, qui renforcent sensiblement l'action de ces huiles. Les huiles anthracéniques et les mélanges à base d'huiles anthracéniques se sont montrées sensiblement inférieurs. De même, les colorants nitrés utilisés seuls n'ont pas eu d'efficacité suffisante même à des doses assez élevées (3, 4). Pour les traitements d'hiver, les « huiles jaunes » à base d'huile de *pétrole* et de di-nitro-ortho-crésol présentent un grand intérêt. Elles sont efficaces à des doses relativement faibles (2 %) et agissent également sur certains parasites autres que le Pou de San-José, en particulier sur divers Acariens, les œufs de pucerons, etc. En traitement d'été, de bons résultats ont été obtenus avec le mélange d'huile de pétrole d'été et de DDT. Ceci est dû en partie à la persistance assez longue de l'action du DDT qui préserve les végétaux traités de la réinfestation par les larves mobiles. (3) Les esters phosphoriques aux doses habituelles de leur emploi ne sont que très peu efficaces mais leur utilisation peut être envisagée en mélange avec des huiles de pétrole à condition, toutefois, que ces dernières soient émulsionnées avec un émulsifiant neutre.

L'éradication de petits foyers isolés du Pou de San-José semble être possible dans certains cas même sans arrachage de toute la végétation contaminée mais une attention toute particulière doit être portée aux Cassissiers et aux Groseilliers qui sont généralement très infestés et sur lesquels le parasite est difficile à combattre. Il est préférable de procéder à la destruction de ces arbustes alors que pour les arbres fruitiers on peut se limiter à des traitements énergiques et répétés.

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(1) Nepveu P. et Vasseur R. « Sur la contaminabilité des plantes horticoles et spontanées par le Pou de San-José (*Qu. perniciosus* Comst.) » *C.-R. Acad. Agric. France, N° 10.* Paris, juin 1946.

(2) Nepveu P. et Vasseur R. « La contaminabilité de la flore horticole française par le Pou de San-José (*Qu. perniciosus* Comst.) ». *Revue techn. Prot. Vég. T. I, fasc. 3,* Paris 1948.

(3) Dumas P. et Vasseur R. « Les traitements coccicides des arbres fruitiers. » *Bull. Techn. Inform. Ing. Serv. Agric. N° 49,* Paris, Mars-Avril 1950.

(4) Vasseur R. et Bianchi H. « Quelques données nouvelles sur la lutte chimique contre le Pou de San-José (*Quadraspidiotus perniciosus* Comst.) *C.-R. Acad. Agric. France. N° 7,* Paris, Avril 1949.

M. R. VASSEUR (*Station Centrale de Zoologie Agricole, Institut National de la Recherche Agronomique, Versailles*).

presented a paper, of which the following is a summary, on the results of research in France into certain aspects of the biology of San José Scale and its control.

The study of San José Scale (*Quadraspiotus perniciosus* Comst) which began in France in 1940 in the region of Cannes-Mandelieu (Nepveu), and was subsequently continued in the Lyons region and in some smaller areas of infestation further North (Vasseur) has been concentrated mainly on the following points :

1. The biology of the insect in relation to climatic conditions.
2. Susceptibility of the different species of wild and cultivated plants.
3. Control measures.

Bio-ecological observations have shown that the San José Scale has 3-4 generations in a year in the S. of France ; 2 complete and perhaps a partial third generation in the Lyons district ; and 2 only at Nevers and Bourges. The damage caused by the insect does not, however, always seem to be in direct proportion to the number of generations in a year. With 2 generations in the year the damage is often almost as serious as in the South, where there are about twice as many generations. This seems to be due at least in part to the high mortality of the larvae in Summer, which is much higher in hot climates. Hibernation conditions also have some influence ; in fact in the Lyons district and in the more northerly areas of infestation, the S. J. Scale hibernates exclusively as first stage larvae, which are very resistant to cold, whilst further south, the hibernants are more varied and include other stages of evolution, 2nd stage larvae and adults, which are much more sensitive to variations in temperature. It appears, therefore, that the scale is particularly adapted to regions of temperate climate, corresponding roughly to regions of peach and pear cultivation. If infestation spread, large scale damage would result everywhere where climatic conditions permitted two complete generations in a year. According to the ecological requirements of the insect, this would be the case at Clermont-Ferrand, Le Mans, Strasbourg, and Nancy for example, in S. Germany (Wurtemberg and Bavaria) and in most countries of central Europe. On the other hand there would only be one annual generation in the North of France (Lille) in the Hamburg region, and in Denmark, where, in consequence, the danger would be less.

Regarding the susceptibility of different plants, fairly detailed lists have recently been published (1.2). It must be noted, however, that although these lists are the result of observations and precise and numerous experiments, they can have no absolute value and must only be considered as a basis. The degree of susceptibility can be different for the same kind of plant in different climatic conditions, and it can also differ according to the condition of the plant.

In recent years numerous insecticides have been tested for the control of San José Scale. The best results have been obtained with emulsions of petroleum oils used alone or mixed with other insecticides such as dinitro-ortho-crésol, for example, which noticeably increase the action of these oils. Tar oils and mixtures with a base of tar oils have proved much less effective. Similarly, nitrated colouring matter used alone has not been sufficient even with heavy doses. (3.4.) For winter treatment, « yellow oils » with petroleum and dinitro-ortho-crésol base are very good. They are effective with relatively low doses (2 %) and are equally effective on other parasites besides the San José Scale, in particular on different mites, the eggs of aphis, etc. In summer treatments, good results have been obtained with the mixture of summer petroleum oil and DDT. This is due partly to the fairly lengthy duration of action of the DDT which protects the treated

plants from reinfestation by mobile larvae (3). Phosphoric esters at the usual dosages have only slight effect, but their use might be considered mixed with petroleum oils, always provided that the latter are emulsified with a neutral emulsifier.

The wiping out of small isolated outbreaks of San José Scale seems to be possible in certain cases even without the removal of all the contaminated vegetation, but very special attention should be paid to blackcurrant and other currant bushes which are generally heavily infested and on which it is very difficult to deal with the parasite. It is preferable to destroy these bushes, whilst for fruit trees, it is sufficient to carry out energetic and repeated treatments.

Le Professeur MELIS (Italie)

a fait les observations dont un résumé est donné ci-dessous :

1. Le Dr DREES avait présenté une liste provisoire (qui n'est pas reproduite dans ce rapport) des plantes attaquées par le Pou de San José.

Le Professeur MELIS dit que cette liste ne correspond pas aux faits constatés en Italie, car la plupart des espèces de plantes citées sont très rares ou manquent tout à fait en Italie.

En outre, parmi les plantes attaquées, on a fait figurer l'oranger et le citronnier. En Italie, l'*Aspidiotus perniciosus* n'a jamais été trouvé sur ces plantes, bien que des zones d'infestation sur des plantes-hôtes s'en trouvent rapprochées. Sur d'autres espèces de plantes, la présence de l'*Aspidiotus perniciosus* est occasionnelle comme c'est le cas, par exemple, pour la vigne (*Vitis vinifera*) sur laquelle l'insecte a été trouvé quelques fois, mais où il n'a jamais été constaté qu'il se soit reproduit.

Dans l'ensemble, la liste des plantes-hôtes est, pour l'Italie, beaucoup plus courte et beaucoup moins alarmante que celle présentée par la délégation allemande, comme cela résulte de la monographie « Contributo alla conoscenza dell'*Aspidiotus perniciosus* » (Contribution à l'étude de l'Aspidiotus perniciosus) publiée par le Professeur Melis dans le volume de « Redia » 1943 (page 170, avec dessins et 10 tableaux illustrés).

2. *Lutte.* Le Professeur Melis considère comme indispensable que la lutte contre l'*Aspidiotus perniciosus* soit appliquée rigoureusement aux plantes de pépinières au moyen de traitements à l'acide cyanhydrique.

Comme cela a été décrit dans la monographie déjà citée plus haut, dès 1934-1935, on effectuait en Italie la désinfection en cabine de fumigation, pour toutes les plantes de pépinières destinées à l'exportation ou à être transplantées.

Si l'on désinfecte les plantes à la température de 20° C et que les plantes ne sont pas humides ou mouillées, on obtient le 100 % de mortalité des cochenilles.

Le traitement s'effectue avec une concentration de 5 grammes de cyanure de soude par mètre cube de volume d'air. Il est procédé en Italie depuis quinze ans selon les méthodes qui ont été décrites dans le travail de M. Mathys. Parce que l'on est certain, avec ces méthodes de désinfection, d'obtenir 100 % de mortalité, le Professeur Melis croit qu'il n'existe aucune base scientifique qui justifie, pour un pays quelconque, l'interdiction de circulation des plantes de pépinières. Ceci est également le cas si l'on tient compte du fait que tout pays, au moment de l'introduction des plantes, peut effectuer la désinfection avec l'assurance d'obtenir 100 % de mortalité des cochenilles.

Les plantes en état de repos, traitées à la concentration indiquée, ne souffrent aucunement du traitement.

PLANTES SUR PIED

Les conditions indiquées pour la désinfection des plantes de pépinières en cabines (température 20° C, ambiance sèche, etc.) ne sont possibles à atteindre que rarement en plein champ et sous tente, en hiver. C'est ainsi que dans la zone de Naples, durant plusieurs saisons d'hiver successives, il n'y a eu que trois jours appropriés pour le traitement, pendant qu'au cours de la bonne saison, les fumigations cyanhydriques peuvent endommager les plantes, non seulement par suite d'une faible action de l'acide, mais encore par suite d'une action mécanique provenant du montage et du démontage de la tente.

Les plantes productrices de fruits peuvent également être désinfectées par des traitements à base d'huiles minérales lourdes, comprenant ou ne comprenant pas l'adjonction de « dinitrorthocrésol », ceci pendant l'hiver, par des journées sèches et pendant les heures les plus chaudes du jour.

Les traitements suggérés par le Docteur Beran, à basses températures (sous zéro) ne peuvent pas être appliqués à la plus grande partie des arbres fruitiers en Italie, parce que les plantes — pendant les journées caractérisées par une basse température — se recouvrent d'une couche de gelée qui empêche le liquide insecticide d'arriver jusqu'aux cochenilles. Si les traitements sont effectués dans une atmosphère sèche, la lutte peut être utile même par une basse température.

Les polysulfures sont aussi de très bons insecticides pour lutter contre l'*Aspidiotus*, selon les méthodes suggérées et démontrées dans la Note N° 20, éditée par la Station d'Entomologie Agraire de Florence et à laquelle a été donné la plus large diffusion en Italie.

Il ne semble pas indiqué de conseiller le traitement avec des huiles minérales légères durant l'hiver, car si elles tuent le Pou de San José, elles ne détruisent pas, cependant, les autres insectes nuisibles qui se trouvent sur les plantes, comme le font les huiles minérales lourdes.

Il ne convient pas de traiter les plantes durant l'été au moyen d'huiles minérales, car celles-ci peuvent altérer la qualité organique des fruits.

Le Professeur Melis a publié en 1951 un travail sur la « Biologie de l'*Aspidiotus perniciosus* ». Il désire attirer avant tout l'attention de la Conférence sur ce travail, parce que les considérations qui s'y trouvent formulées sont de nature à fournir des arguments en faveur du libre échange des fruits frais.

Prof. MELIS (Italy) made the observations which are summarised below :

1. Dr Drees had presented a provisional list (not reproduced in this report) of plants attacked by San José Scale. Prof. Melis said this list does not correspond to the facts found in Italy, because the greater part of the species of plants mentioned are very rare or are not found at all in Italy.

Further, among the attacked plants is shewn the orange tree and the lemon tree. In Italy San José Scale has never been found on these plants, although there are nearby zones of infestation on host plants. On other species of plants, the presence of San José Scale is occasional, as, for example, on the Vine (*Vitis vinifera*) on which the insect has sometimes been found, but on which it has never been known to reproduce itself.

As a whole, the list of host plants is, for Italy, much shorter and much less alarming than that presented by the German delegation, as shewn in the monograph « Contribution to the study of *Aspidiotus perniciosus* » published by Prof. Melis in the 1943 volume of Redia, page 170, with drawings and 10 coloured plates.

2. *Control.* Professor Melis considers as indispensable that the fight against San José Scale be applied rigorously to nursery plants by Hydrocyanic treatment.

As described in the monograph quoted above, disinfection in fumigation chambers has been carried out in Italy since 1934/5, for all nursery plants for exportation or intended for transplanting.

If the plants are disinfected at a temperature of 20° C and the plants are not damp or wet, 100 % mortality of the scales is obtained.

The treatment is carried out with a concentration of 5 grams of Sodium Cyanide per cubic meter of air. It has been done in Italy for 15 years according to the methods described in the paper by Mr. Mathys. Because one can be certain with these methods of disinfection to obtain 100 % mortality, Prof. Melis considers that there exists no scientific basis which justifies for any country the prohibition of traffic in nursery stock. This is also the case if it is remembered that every country, at the moment the plants are introduced, can carry out disinfection with the assurance that 100 % mortality will be achieved.

Plants not actively growing, when treated with the concentration indicated, suffer in no way from the treatment.

GROWING PLANTS

The conditions indicated for the disinfection of nursery stock in chambers (temperature 20° C, dry atmosphere, etc) can be achieved only rarely in the open and under canvas in Winter. Thus, in the region of Naples, during several successive Winters, there were only three days suitable for carrying out treatment, whilst in the good season, the fumigations with Hydrocyanic acid can damage the plants, not only by reason of a weak acid action, but through a mechanical action arising from the erection and taking down of the tent.

Fruit trees can also be disinfected by treatment with heavy mineral oil base, with or without the addition of « dinitrorthocresol », this in Winter, on dry days and during the warmest hours of the day.

The treatments suggested by Dr Beran at low temperatures (below zero) cannot be applied to the greater part of the fruit trees in Italy, because the plants — during the days characterised by a low temperature — are covered with a layer of frost which prevents the insecticide liquid from reaching the scales. If treatment is carried out in a dry atmosphere control can be useful even if the temperature is low.

« Polysulphides " are also very good insecticides for fighting the San José Scale, according to the methods suggested and explained in the note No. 20 edited by the Florence Entomological Station which was given the widest possible circulation in Italy.

It does not seem desirable to advise treatment with light mineral oils in Winter, because if they kill the San José Scale, they do not kill the other harmful insects on the plants as do heavy mineral oils.

It is not suitable to treat plants in Summer with mineral oils, because these can affect the organic quality of the fruits.

Prof. Melis published in 1951 a work on the Biology of the San José Scale. He desires particularly to draw the attention of the Conference to this work, because the considerations contained in it are such as to furnish arguments in favour of the free exchange of fresh fruit.

Prof. BENLLOCH (Espagne)

Je dois féliciter le docteur Drees et M. Mathys des travaux qu'ils ont présentés hier après-midi, et bien qu'il ne nous soit pas possible d'analyser leurs remarques en détail, nous tenons à participer par quelques observations, à l'esprit constructif qui préside aux délibérations de cette Conférence.

En nous référant au mémoire présenté par le docteur Drees, et aux observations formulées par le professeur Melis, nous estimons qu'il est nécessaire de faire une distinction entre la simple présence de l'insecte sur la plante-hôte, d'une part, et d'autre part l'apparition de dégâts. C'est ce

dernier point qui doit retenir plus particulièrement notre attention, car il est pratiquement impossible d'envisager des traitements de plantes sur lesquelles ne se trouvent qu'un ou deux insectes, surtout lorsqu'il s'agit de plantes sans intérêt pour l'agriculture, ou de plantes sauvages.

D'autre part, nous croyons que la virulence ou le pouvoir d'infestation du Pou de San José est très variable d'une région ou d'un pays à l'autre.

En Espagne, le premier foyer d'infestation par cette cochenille a été découvert en 1935 dans la vallée du Llobregat (province de Barcelone), et ce n'est qu'en 1949 qu'il a été possible de constater l'infestation sérieuse de certains arbres dans la province voisine de Lérida, de même que deux foyers isolés dans les provinces de Castellon et Valence ; ces derniers foyers ont connu une certaine extension en 1950, mais sont néanmoins demeurés peu importants.

Dans certains cas, les pépiniéristes ne sont pas disposés à pratiquer la fumigation, car même lorsque les arbres semblent être secs — condition préalable pour obtenir l'efficacité voulue — les racines finissent par être affectées par le HCN et l'on peut souvent constater une proportion excessive d'échecs dans les plantations d'arbres qui ont été traités.

En Espagne, la fumigation à l'acide cyanhydrique est pratiquée depuis 1907. Nous disposons par conséquent d'une expérience de plus de quarante années, et c'est pourquoi nous avons déjà étudié tous les aspects du sujet traité par M. Mathys, principalement à la Station de Phytopathologie de Burjasot (Valence). A notre avis, il serait souhaitable que M. Mathys et cette station puissent prendre contact pour échange de vues.

Enfin, sur l'utilisation d'esters phosphoriques tels que le produit E. 605, la courte expérience dont nous disposons (ces produits n'étant pas autorisés en Espagne) nous permet de déclarer que nous n'avons pas obtenu de résultats favorables. Il est possible que cela s'explique par le fait que les conditions de l'Espagne, qui se rapprochent de celles de l'Italie, sont fort différentes de celles existant en Allemagne.

Prof. BENLLOCH (Spain)

I must congratulate Dr. Drees and M. Mathys for the papers which they read yesterday afternoon, and although a detailed analysis of their remarks is impossible, I would like to refer to the constructive spirit which reigns in the discussions of this conference.

Referring to the report presented by Dr. Drees and the observations made by Prof. Melis, I think it is necessary to make a distinction between the simple presence of the insect on the host plant and the occurrence of damage. It is the latter which must interest us most, since it is practically impossible to carry out treatment on plants which have only one or two insects, especially when it is a question of plants without agricultural interest or wild plants.

Further, we think that the virulence or infestation power of the San José Scale varies a lot from one region or Country to another.

In Spain the first outbreak of this cochineal was discovered in 1935 in the Llobregat valley (Province of Barcelona) and not until 1949 was there appreciable infestation of trees in the neighbouring Province of Lérida, and two isolated cases in the Provinces of Castellon and Valencia, which spread somewhat in 1950, but were not of great importance.

In certain cases the nurserymen are not inclined to fumigate, because even with trees which are apparently dry — a necessary condition for obtaining the required effect — the roots are finally affected by the HCN and there is often an excessive proportion of failures in plantations where the trees have been treated.

In Spain hydrocyanic acid fumigation has been practiced since 1907. We therefore have more than 40 years experience, and for that reason all the aspects of the subject dealt with by

M. Mathys had already been studied, mainly at the Phytopathological Station of Burjasot (Valencia). I think therefore that it would be desirable for M. Mathys and this Station to get together.

Finally, in regard to the use of Phosphoric esters such as E. 605, with such short experience as we have had (these products not being allowed in Spain), we did not obtain favourable results. It is possible that the conditions in Spain, which resemble more those of Italy, but both of which are very different from those in Germany, can explain these facts.

THE CONTROL OF THE SAN JOSE SCALE IN AUSTRIA

Dr F. Beran

Résumé. — *L'auteur décrit brièvement les résultats acquis en l'espace de vingt années d'activité, en Autriche, quant à la biologie du Pou de San José et la lutte contre ce parasite. Des produits mixtes, à base d'huiles minérales et contenant du dinitroorthocrésol, ont de bons effets ovicides et connaissent, pour cette raison, une préférence. Les préparations mixtes d'huiles de goudron et huiles minérales, qui combinent l'effet ovicide de l'huile de goudron avec l'effet toxique, sur le Pou de San José, de l'huile minérale, sont également populaires car elles agissent sur les œufs des tétranyques qui sont des parasites les plus sérieux pour les arbres fruitiers, en Autriche.*

Une nouvelle méthode de pulvérisations d'hiver, appelées « pulvérisations de gel, » s'est développée durant ces dernières années. A des températures au-dessous de zéro, l'effet ovicide et insecticide des émulsions d'huiles est doublé, de telle sorte que les concentrations peuvent être réduites de moitié.

A des températures de 5° C à 20° C, l'efficacité de l'HCN est très faible. D'autres produits gazeux, tels que l'oxyde d'éthylène, le bromure de méthyle et l'hydrogène phosphoré ont été retenus, mais les concentrations nécessaires pour l'efficacité de ces gaz rendent leur utilisation peu pratique.

L'auteur conclut en donnant les résultats de recherches s'appliquant à différents aspects de la biologie du Pou de San José. Ceux-ci comprennent des listes de variétés sensibles et de variétés résistantes de pommiers et de poiriers, de même que de parasites naturels de la cochenille, dont l'existence a été constatée en Autriche.

We have been working for 20 years on the question of biology and control of the San José Scale, and we have practical experience in using spraying material and gas products during this period. In the control of the San José Scale we have obtained better results by using spraying materials with combined products based on mineral oils and including Dinitroorthocresol. These materials have the advantage that they have a very good ovicidal effect and therefore they are preferred in our country. We also use combined preparations of tar oils and mineral oils, called in Austria «mineral oil carbolineum ». These have the advantage of combining the good ovicidal effect of a clean tar oil product with the toxicity against San José Scale of mineral oils. They have proved satisfactory in exterminating the San José Scale and also the eggs of the red spider. The latter has been one of the most serious pests of our fruit trees for some years. This is the main reason that we have given up using the clean tar oil products, which are not sufficiently effective against the eggs of red spider.

Within the last years a new method of winter spraying has been developed called « frost spraying ». The insecticidal and ovicidal effect of oil emulsions is doubled if the application is carried out at temperatures below O° C. This effect can be explained by the fact that the oil emulsion is fixed on the bark immediately after application by freezing, and therefore the oil depo-

sit is doubled in comparison with spraying above 0° C. Therefore it is possible to reduce the concentrations by half.

Lately we have tested the products of Pest Control Ltd. « TABP » (Dinitrobutylphenol). A 1 % mixture of this product showed nearly 100 % effect against San José Scale. The ovicidal effect, especially against red spider, is also very high.

I have proved by investigations that the extermination of the Scale with hydrocyanic acid gas is according to the law of Haber, namely that the relation between gas concentration and fumigation time is constant.

Furthermore I want to state that the efficiency of HCN at 5°-20° C against the San José Scale is very low. In addition we have gone into the question of other gas products instead of HCN to control the San José Scale, and have tested amongst others Ethylenoxyde, Methylbromide and Phosphine. At a temperature of 20° C Ethylenoxyde is only 100 % successful in 30 gst (i. e. concentration × fumigation time), Methylbromide in 25 gst and Phosphine in 30 gst against the San José Scale. Under practical conditions these doses are too high, and the use of these gas products is therefore impracticable. Furthermore, Methylbromide in an effective concentration is injurious to most plants.

As to the biology of the pest the following has been found out :

The San José Scale usually produces 2 generations annually in Austria ; in very hot summers there are 3 generations. Hibernation takes place invariably at the first larvae stage (black scale stage).

After winter the development is completed in the beginning of May ; about 3-4 weeks later the female starts shedding the crawlers, 150-200 per female.

The first appearance of larvae is sometimes in the beginning of June, the second at the end of August, and a third in some years at the end of September.

The natural mortality is in winter 50-60 %, in very cold years up to 85 % ; during the summer months the mortality is small, on apples and pears about 10-12 %, on stone fruit 25-30 %.

The San José Scale shows a different reaction towards various hosts, even towards different sorts of the same kind of plant. There are clear differences according to the parent stock.

The varieties of pears which are most susceptible are : Gute Luise, Vereins Dechantsbirne, Williams Christbirne, Clapps-Liebling, Clairgeau, Triumphe de Vienne, Herzogin Elsa.

Resistant varieties are : Gellerts-Butterbirne, Präsident Drouard, Notar le Pin.

Susceptible apple varieties : Cox Orangen Reinette, Laxton Superb, Gelber Bellefleur, Boskoop, Goldreinette, Winter-goldparmâne, Kanada Reinette, Weisser Winter Kalville, Klarapfel, James Grieve.

Resistant apple varieties : Up to now only local sorts, i. e. Roter Eiserapfel.

Natural enemies of the San José Scale in Austria :

The following parasites of San José scale have so far been found in Austria : *Aphitis diaspidis*, *Aphitis mytilaspidis*, *Azotus marchali*, *Diaspiniphagus similis*, *Aphelinus fuscipennis*, *Polynema fulmeki*, *Cheiloneurinus micriphagus*, *Archenimus bicolor*. The most frequent parasite is *Aphitis diaspidis*. The parasites are found only on the first and second black scale stage ; no parasites have been noticed on male scales. Scales infested by parasites have also been found on fruits.

Further San José Scale enemies are the two Coccilenidae, *Chilocorus bipustulatus* and *Exochomus quadripustulatus* (imago and larvae). Others are the bug *Deraeocoris ruber*, which eats the San José Scale already in its first larvae stage, and the larvae of *Chrysopa vulgaris*. Both the latter are scarce.

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